Aviation Week and Space Technology

June 26, 1961

Super Frelon Program Involves Four Countries

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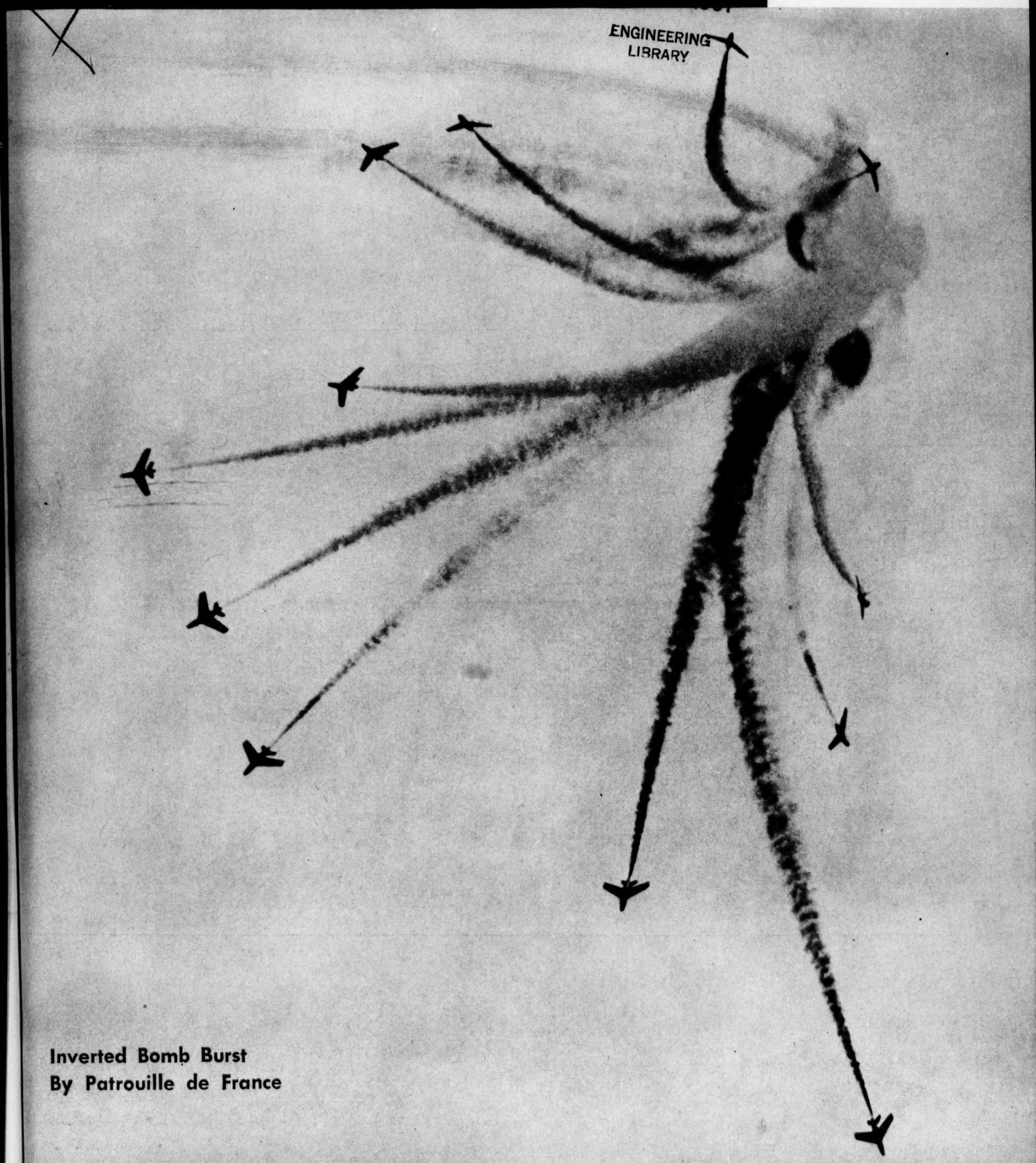


Inverted Bomb Burst
By Patrouille de France

ANOTHER ASPECT OF THE MARQUARDT MISSION

ELECTRIC PROPULSION

Sustained space travel, free from gravitation in a natural vacuum, presents new and difficult problems in the propulsion and control of space vehicles. Electric propulsion promises a practical and economical means of accomplishing space exploration programs.

The three main types of electric engines, while varying in performance specifications, share common advantages over chemical engines. The electrothermal, electromagnetic, and electrostatic engines offer specific impulses greater than 1,000 seconds and thrust durations measured in weeks to months. As a result, electric propulsion systems have the capacity to deliver much larger payloads over longer distances than will conventional rockets. Power for these electric engines can be drawn either from nuclear energy sources built into the vehicle or from solar radiation.

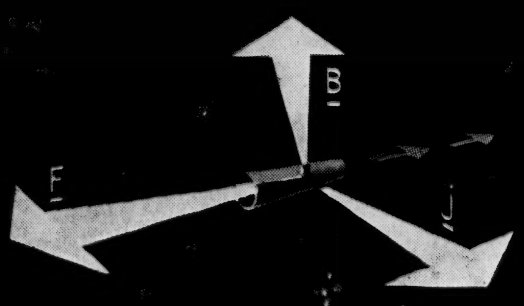
The Marquardt Corporation — long a leader in the field of propulsion — is intensively engaged in a variety of unique electric propulsion projects. An example in the electrothermal area is the Resistojet. Here the hydrogen propellant passes over an electrically heated resistance element prior to expansion in a deLaval nozzle. The Resistojet provides r liability, long life, direct coupling to the power supply, hig efficiency, a simple starting cycle, and throttleability.

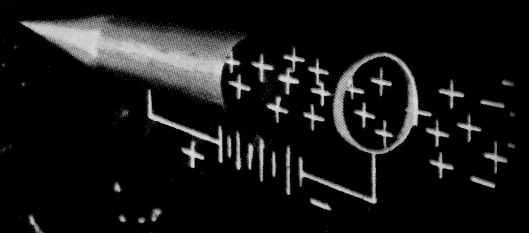
The Marquardt Corporation's efforts in the space propulsio and control fields serve to typify yet another aspect of th Marquardt Mission.

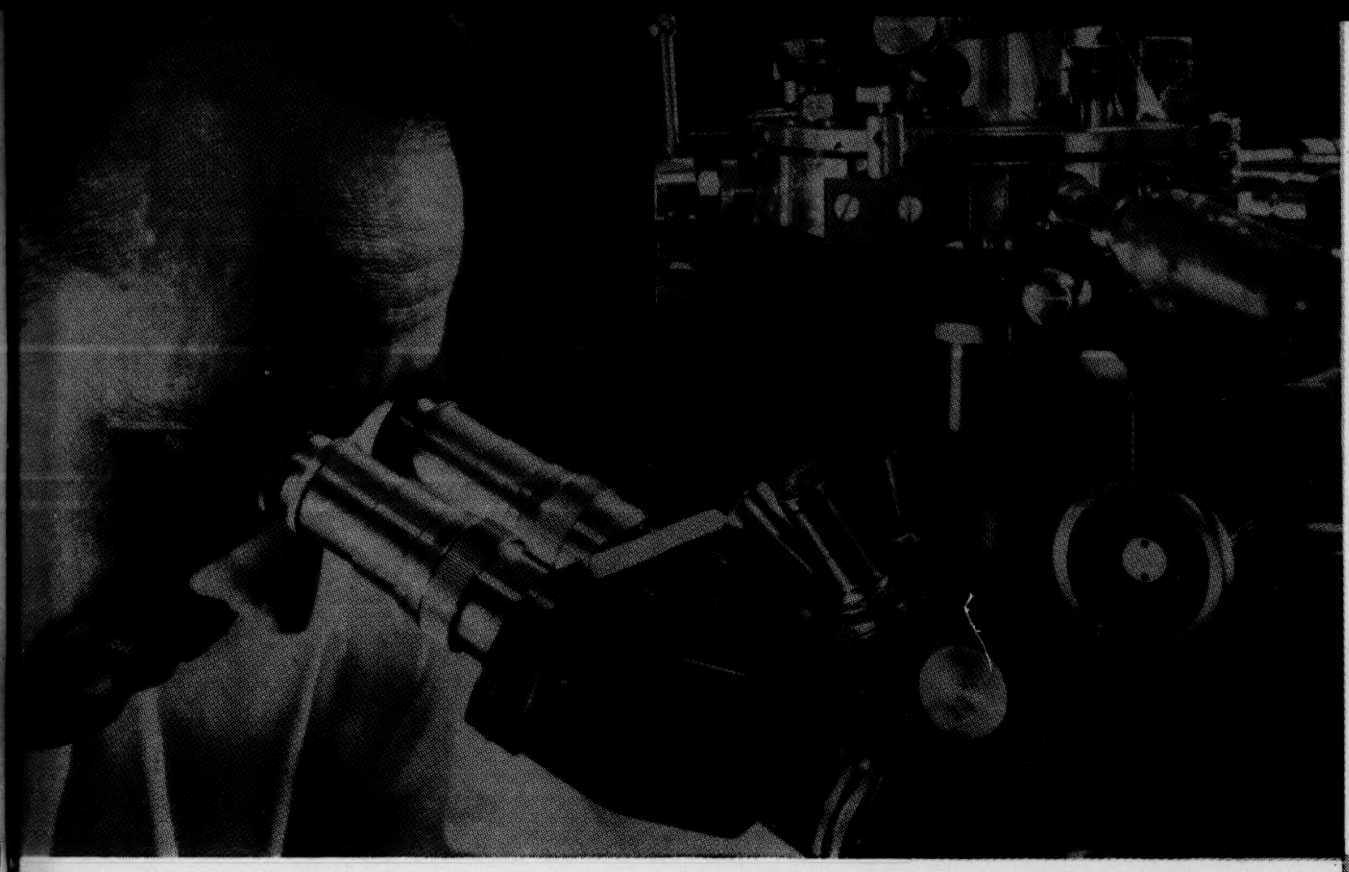
Creative engineers and scientists are needed. All qualifie applicants will receive consideration regardless of rac creed, color, or national origin.

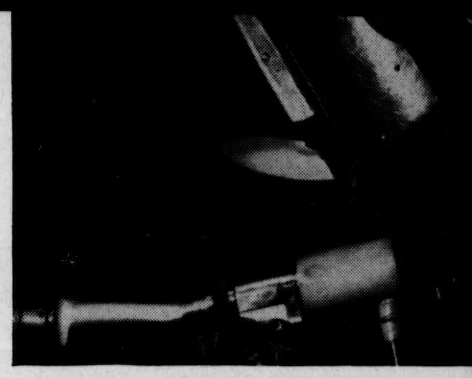
THE Marquardt CORPORATION

CORPORATE OFFICES, VAN NUYS, CALIFORNIA









Extremely high temperature ma terial problems encountered on re entry into earth's atmosphere ar studied with the aid of a plasm jet capable of 30,000°F.

Basic effects of elevated temperatures on various materials are viewed and photographed with the hot stage microscope.

CAPABILITY is spelled

r-e-s-e-a-r-c-h

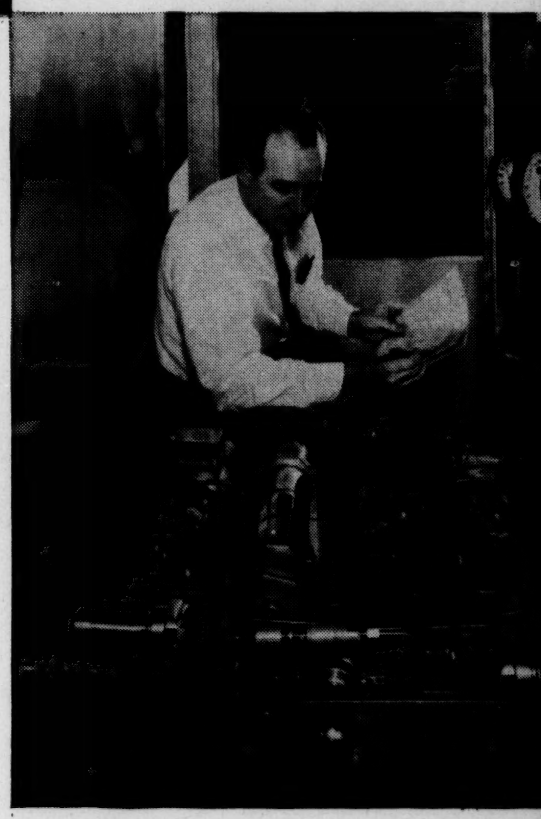
In technology and facility, Vickers continually matches your needs

New fluid power and hot gas systems for aerospace vehicles still in the idea stages are being developed at Vickers. Techniques for converting basic energy into precisely controlled power are continuously being sought by experienced teams of research specialists utilizing the finest scientific equipment.

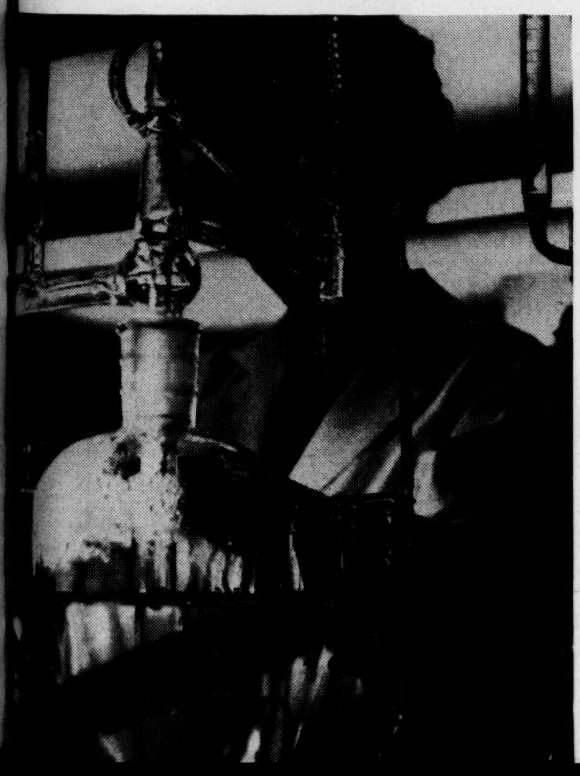
Creative application of the sciences of hydrodynamics, aerothermodynamics, heat transfer, metallurgy and chemistry have been productively blended with Vickers vast experience in the instrumentation and control fields.

The principal effort of Vickers applied research is now concentrated in three areas: 1. advanced systems and components for attitude controls, 2. secondary rocket nozzle injection and 3. hot gas servo actuation. In addition, continuous refinements are being made to the high performance Vickers hydraulic pumps and motors.

The experienced Vickers Application Engineer in your area will welcome the opportunity to fill you in on additional details. In the meantime, write or call for Bulletin A-6002.



Advanced type of primary and emergency fluid power supply system developed and built by Vickers being readied for feasibility test in an environmental chamber.



AERO HYDRAULICS DIVISION
VICKERS INCORPORATED
DETROIT 32, MICHIGAN
TORRANCE, CALIFORNIA

division of
SPERRY RAND
CORPORATION

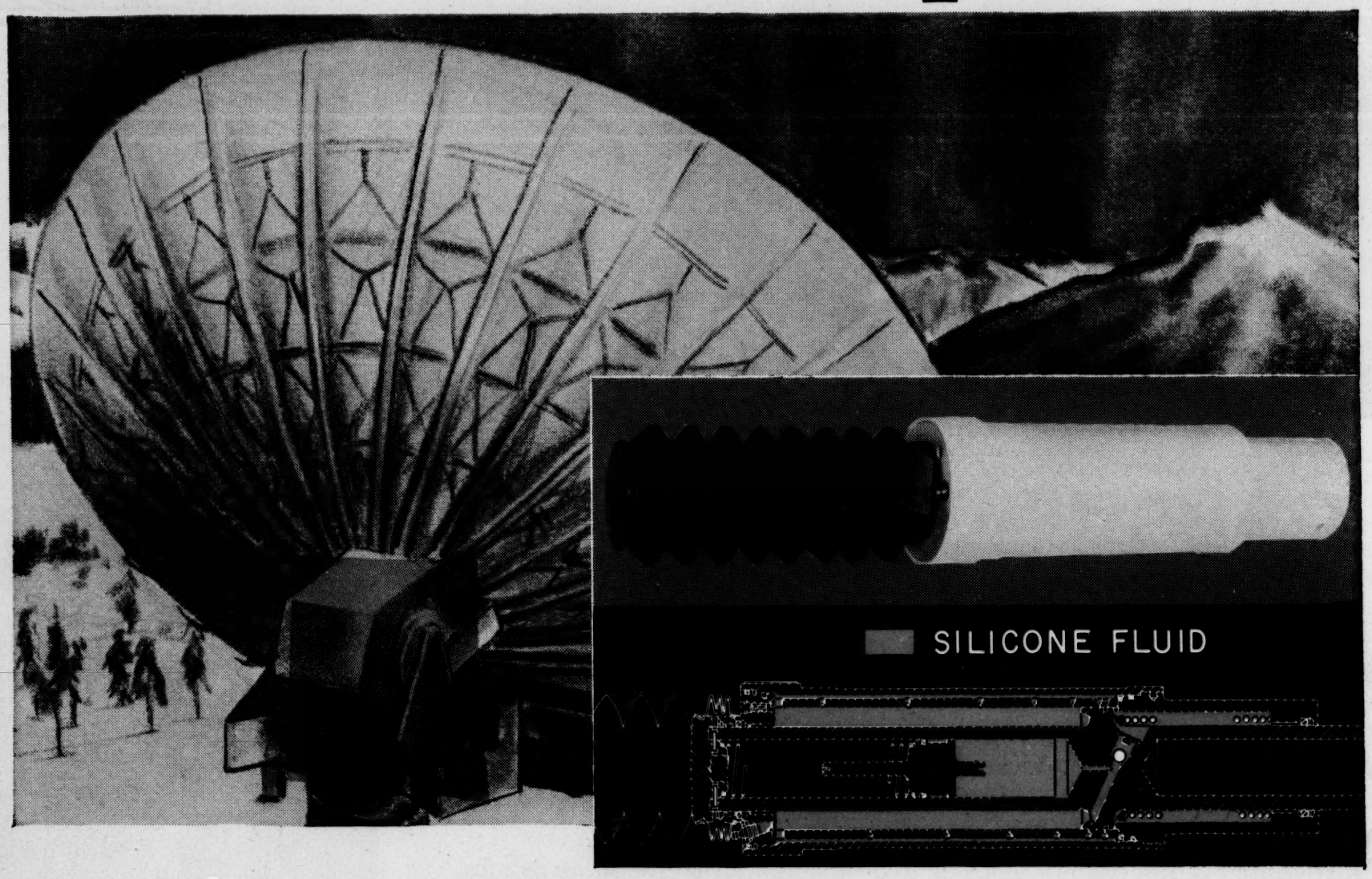
PROGRAMMED POWER IN: FLUID TRANSFER • POWER TRANSMISSION • ENERGY CONVERSION

Analyses of fluids, propellants and special coolants for electronic equipment is carried out in completely equipped chemistry laboratory.

Analog computer (shown) and solid state Univac digital computer give Vickers the important edge in solving complex engineering problems.

9267

Silicones Soak Up Shock



Dow Corning Damping Fluids Unaffected by Cold, Heat, Time

"Steady-state" fluids — that's what some engineers call these exceptionally stable damping media. And steady they are. Their useful range extends from as low as —100 F on the cold side to over 400 F on the hot side! Within these extremes, viscosity varies but little. They're resistant to oxidation and to breakdown under shear; won't sludge; won't corrode metals. Because of such properties, silicone fluids are highly effective media for damping, springing and torque converting.

Illustrated above is one example. It's a Radar Antenna Buffer, designed and built by Houdaille Industries, Buffalo, N. Y. Radar equipped with this unit, "Has silicone; won't over-travel." For that's where the buffering comes in. When the antenna swings to its travel limit, something must give, or the structure may be shock-damaged. What "gives" is the Buffer, and the working medium is Dow Corning silicone fluid. Because the damping fluid's viscosity is unaltered by temperature changes, performance of the Buffer varies less than 1% per 100 Fahrenheit degrees. That's important, because installations of ballistic missile early warning radar, which use the Buffer, may vary from tropic to Arctic.

This is but one of many designs where silicone fluids have aided the product engineer. Others include auto fan drives, aircraft oleo struts, missile accelerometers, and truck scales. If in your design you require a high performance damping or coupling fluid, investigate Dow Corning Silicones . . . the fluids with "steady-state" viscosity. Write to Dept. 1418 for more detailed information.

TYPICAL PROPERTIES OF DOW CORNING 200 FLUID*

Centistokes at 25 C	Pour Point, °F	Visc/temp.[1] Coefficient	Coeff. of Expansion cc/cc/°C
10	—85	0.57	0.00108
50	—67	0.59	0.00104
100	—67	0.60	0.00096
500	—58	0.62	0.00096
1,000	—58	0.62	0.00096
12,500	—51	0.58	0.00096

*Available in a range of viscosities to over a million centistokes.

[1] $1 - \frac{\text{Viscosity at 210 F}}{\text{Viscosity at 100 F}}$

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

AVIATION CALENDAR

July 8-12—15th Annual All-Woman Transcontinental Air Race, San Diego, Calif.-Atlantic City, N. J.

July 13-16—Third Annual Industry Missile and Space Conference and Aerospace Exposition, Michigan Aeronautics and Space Assn., Cobo Hall, Detroit, Mich.

July 16-21—Fourth International Conference on Bio-Medical Electronics, Institute of Radio Engineers, Waldorf-Astoria, New York, N. Y.

July 17—Air Force Contract Aviation Services Symposium, National Aeronautical Services Assn., Hotel Washington, Washington, D. C.

July 19-21—Summer Meeting, Airlines Electronic Engineering Committee, Aeronautical Radio, Inc., Eden Roc Hotel, Miami Beach, Fla.

July 20-21—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Grove Park Inn, Asheville, N. C.

July 24-26—Air Traffic Control Facilities Symposium, Electronic Maintenance Engineering Assn., Mayflower Hotel, Washington, D. C.

July 25-Aug. 10—International Trade Fair and Aviation Exhibition, McCormick Place Exposition Center, Chicago, Ill.

July 26-28—Annual Convention, Southeastern Aviation Trades Assn., Deauville Hotel, Miami, Fla.

July 31-Aug. 11—Conference on Physics of the Solar System and Re-entry Dynamics. For information write: Conference Director, Room 310, Holden Hall, Virginia Polytechnic Institute, Blacksburg, Va.

Aug. 1-3—Fourth Western Regional Meeting, American Astronautical Society, Sher-

(*Continued on page 6*)

AVIATION WEEK and Space Technology

June 26, 1961
Vol. 74, No. 26

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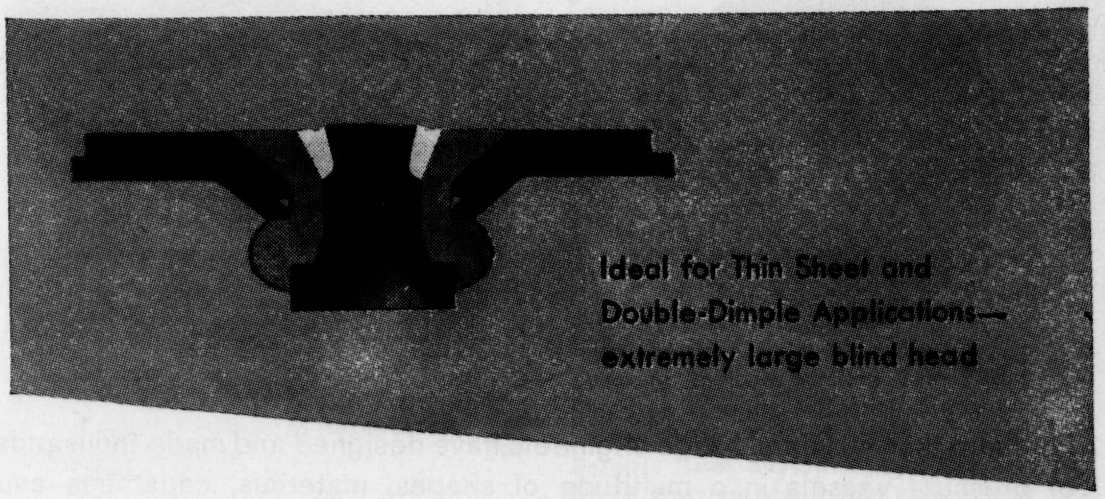
SOLID RIVET STRENGTH WITH BLIND RIVETS

CHERRYLOCK RIVETS for Your Difficult Solid Rivet Applications

Mechanically Locked Stem • Flush Fracture (No Stem Trimming) • Positive Clamp-Up • Full Grip Range • Complete Hole Fill • Minimum Blind Side Clearance • Positive Visual Inspection (Grip Length Marked on Head)



The Bulbed Cherrylock* offers a blind rivet that installs and performs like a solid rivet. Bulbed Cherrylock Rivets will qualify where you are now using solid rivets, offering higher joint strength with greatly increased joint reliability under critical loading conditions—fatigue, shake and sonic vibration.

Now Cherrylock rivets give you a blind rivet that can be used in expensive forgings as well as for joining and attaching sheets and components.

For technical data on Cherrylock Rivets, write Cherry Rivet Division, Townsend Company, Box 2157N, Santa Ana, California.

* Patent Pending

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MORE SHAPES, MORE SIZES, MORE EXPERIENCE!

For more than 40 years, Kidde engineers have designed and made thousands of pressure vessels in a multitude of shapes, materials, capacities and strengths. Today, with pressure vessels an important part of missile or rocket programs, it's only logical that engineers rely on Kidde experience.

Kidde pressure vessels range from doorknob size to 3500 cubic inches capacity; from a life of 10 cycles to 500,000 cycles; pressures up to 20,000 psi. Kidde pressure vessels are made in steel, fiberglass, aluminum —welded or drawn—wire wound—minimum weight for application. Configurations are practically limitless—including cylindrical, spherical, conical, torus. Many are available on an off-the-shelf basis!

In addition to solving current problems in pressure vessel applications, Kidde engineers are also hard at work advancing today's techniques to solve tomorrow's problems. So, if pressure vessels have you stumped, why not call on Kidde for the answer . . . most people do!

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AVIATION CALENDAR

(*Continued from page 5*)

aton-Palace Hotel, San Francisco, Calif.

Aug. 2-4—Summer Meeting on Aerospace Applications for Hydraulic Fluids Test Methods, American Society for Testing Materials, Santa Ynez Inn, Pacific Palisades, Calif.

Aug. 7-9—Guidance and Navigation Conference, American Rocket Society, Stanford University, Palo Alto, Calif.

Aug. 15-17—Cryogenic Engineering Conference, University of Michigan, Ann Arbor.

Aug. 16-18—International Hypersonics Conference, American Rocket Society, Massachusetts Institute of Technology, Cambridge, Mass.

Aug. 19-24—Institute of the Aerospace Sciences/Naval Aviation Meeting, San Diego, Calif. (Classified.)

Aug. 22-25—Western Electronic Show and Convention, Cow Palace, San Francisco.

Aug. 23-25—Fourth Biennial Gas Dynamics Symposium, American Rocket Society, Northwestern Technological Institute, Evanston, Ill.

Aug. 24-26—Sixth Annual National Reunion, OX5 Club of America, Allis Hotel, Wichita, Kan.

Aug. 30-Sept. 1—Third Annual Semiconductor Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, Ambassador Hotel, Los Angeles,

Sept. 4-10—1961 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

Sept. 4-14—Eighth Anglo-American Aeronautical Conference, Royal Aeronautical Society and Institute of the Aerospace Sciences, London, England. Wilbur Wright Memorial Lecture, Sept. 12.

Sept. 6-8—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.

Sept. 10-12—National Convention, National Aeronautic Assn., Westbury, N. Y.

Sept. 13-14—International Operations and Maintenance Symposium, Airwork Corp., Millville, N. J.

Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium (including a forum on the Supersonic Transport) and Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

Oct. 2-7—12th International Astronautical Congress, Washington, D. C.

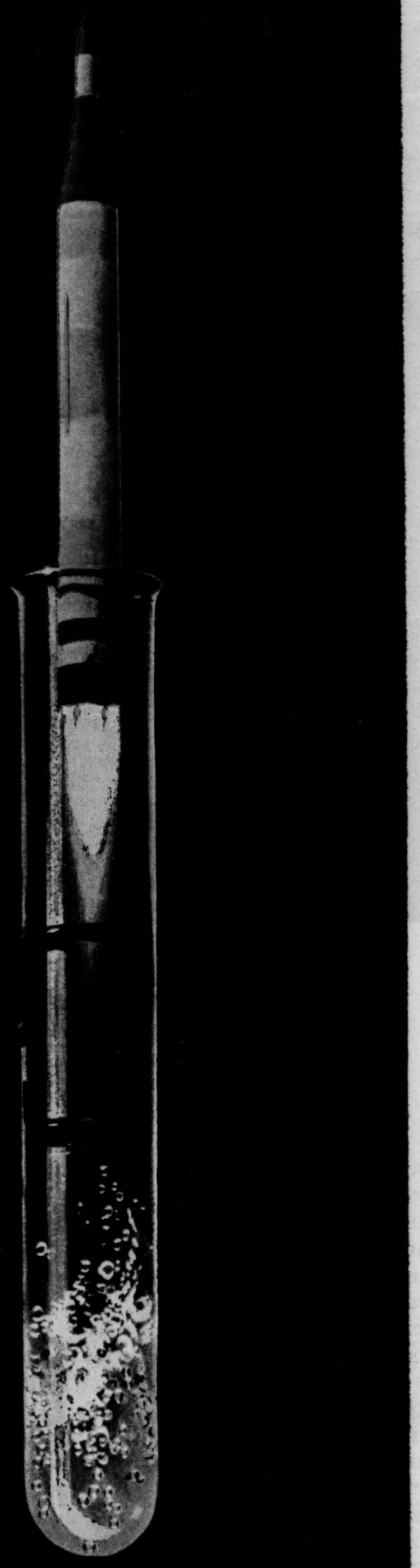
Oct. 9-15—American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Coliseum, New York, N. Y.

Oct. 14-22—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janiero, Brazil.

Oct. 23-24—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

Oct. 23-27—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

The release of motion from energetic materials: this is the chemistry of propulsion. Through basic research on matter, the Chemical Division of Aerojet-General speeds the development of tomorrow's solid and liquid rocket propellants. Aerojet's staff of professional chemists is the largest in the American rocket industry.



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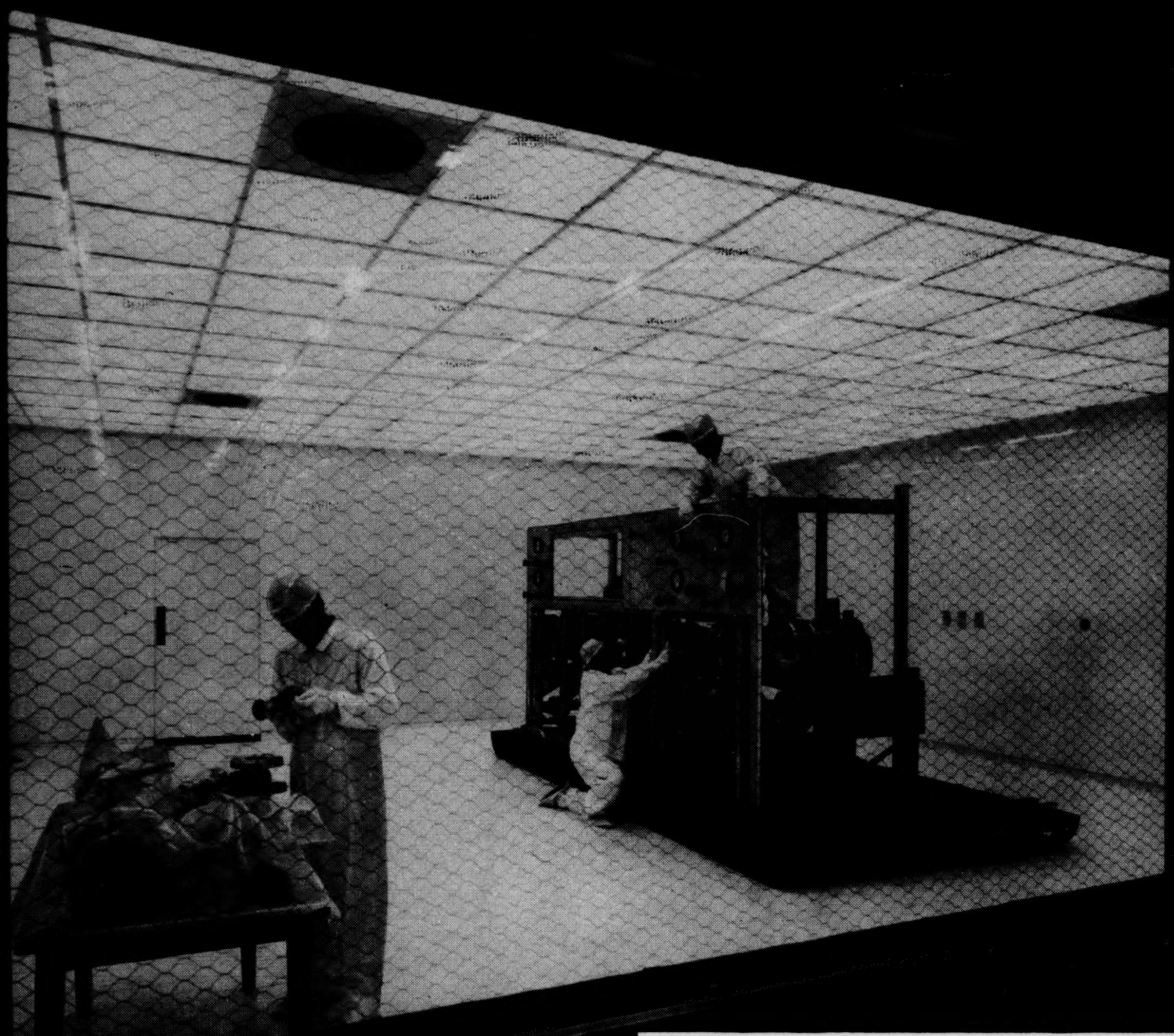

Titan II unit shown in Hamilton Standard White Room for assembly and checkout. Unit is designed to pump and meter propellants to first and second missile stages at rates up to 190 gpm and pressures to 150 psig.

White room for the Titan II propellant transfer system

Development and production of equipment for handling extremely volatile missile fuels—like the propellant transfer unit for The Martin Company's Titan II—demands a contamination-free environment, controlled to within 0.3 microns. Hamilton Standard's new White Room, especially designed for building missile fuel handling systems, even surpasses the exacting requirements of a hospital operating room. It provides 900 square feet of ultra-modern assembly and testing equipment. Detailed construction care and strict control procedures will maintain immaculate conditions . . . always.

Building a propellant transfer unit for the Air Force Titan II missile program is just one of several recent GSE projects in which extreme cleanliness has been a major consideration. This package unit is skid-mounted, electrically powered, manually controlled (with automatic safeties), and capable of pumping either fuel or oxidizer. Performance is measured by its ability to absolutely contain toxic fluids and vapors. To meet these requirements, Hamilton Standard developed important new concepts in sealing and system reliability.

The White Room's capabilities work hand in hand with other key controls to provide manufacturing quality, functional reliability, low system cost, and on-time delivery of all Hamilton Standard Ground Support Equipment.

For the solution to your missile fuel handling problems . . . or any GSE assignment from miniature components to complete weapon support systems, phone: Manager, Ground Support Equipment Department, Hamilton Standard, Windsor Locks, Connecticut; or write for illustrated brochure.

UNITED AIRCRAFT CORPORATION

HAMILTON STANDARD DIVISION

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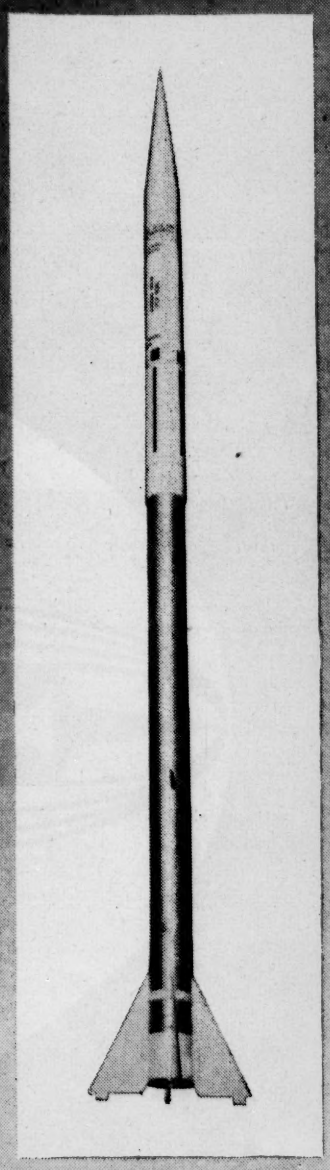
Mach 6 speeds . . . target deployment capability up to 170,000 feet . . . 210-pound instrument payload. This is Aeronca's newly-developed UPSTART (Universal Parachute Supported Tactical And Research Target) . . . one of the world's most versatile testing and training missiles. Designed, developed and produced completely by Aeronca's Defense Products Group, UPSTART embodies important advances in magnesium-thorium fabrication and technology. A recognized leader in honeycomb and "Thermantic" structures, Aeronca has also made major advances in fabricating complex aerospace structures from special high-temperature steels, and exotic metals. Today, Aeronca holds complete system contracts for advanced detection systems, training weapons and ground support equipment. Capabilities range from studies of optimal control systems for space vehicles to production of commercial and military airframe structures.



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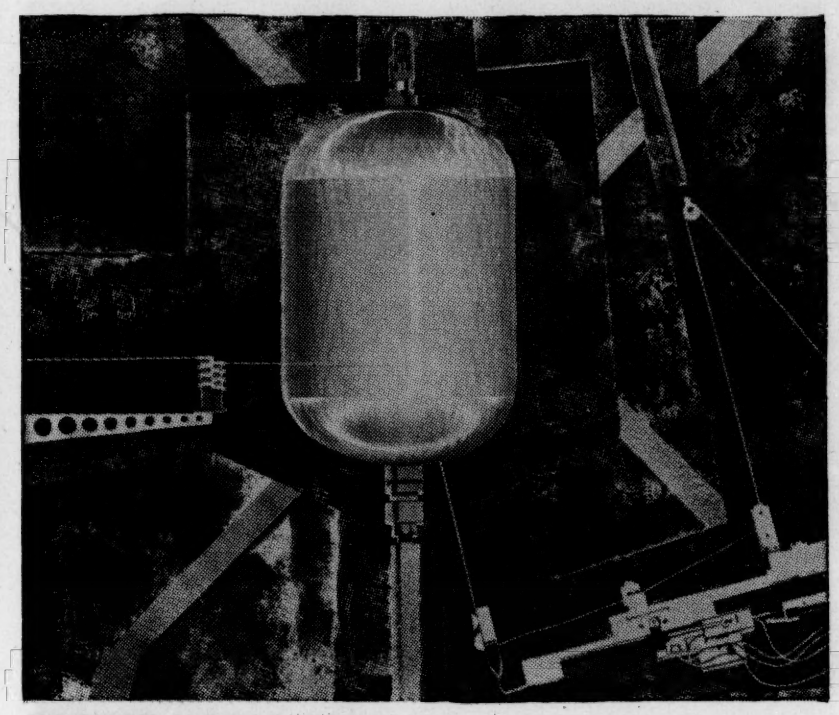
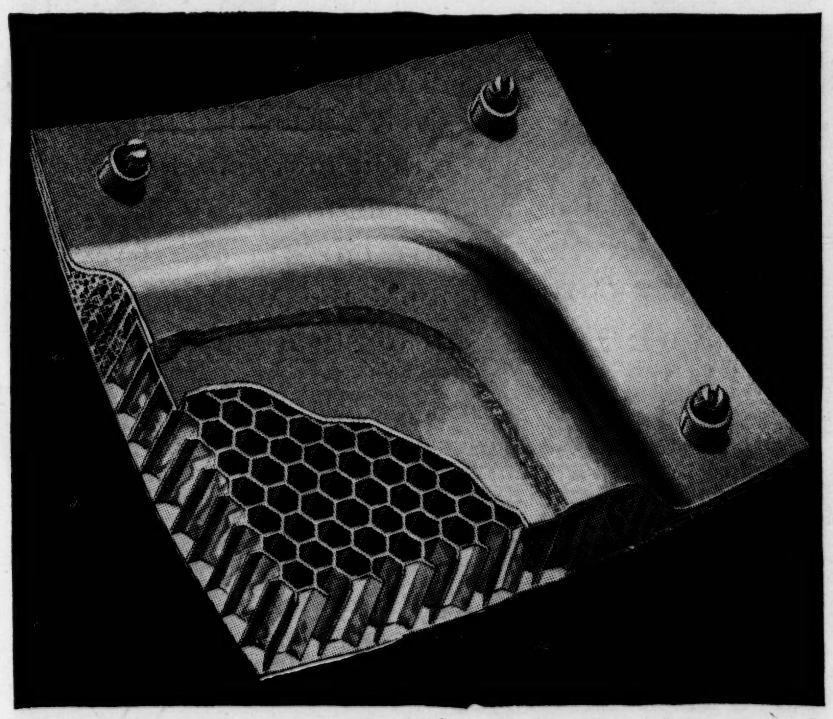
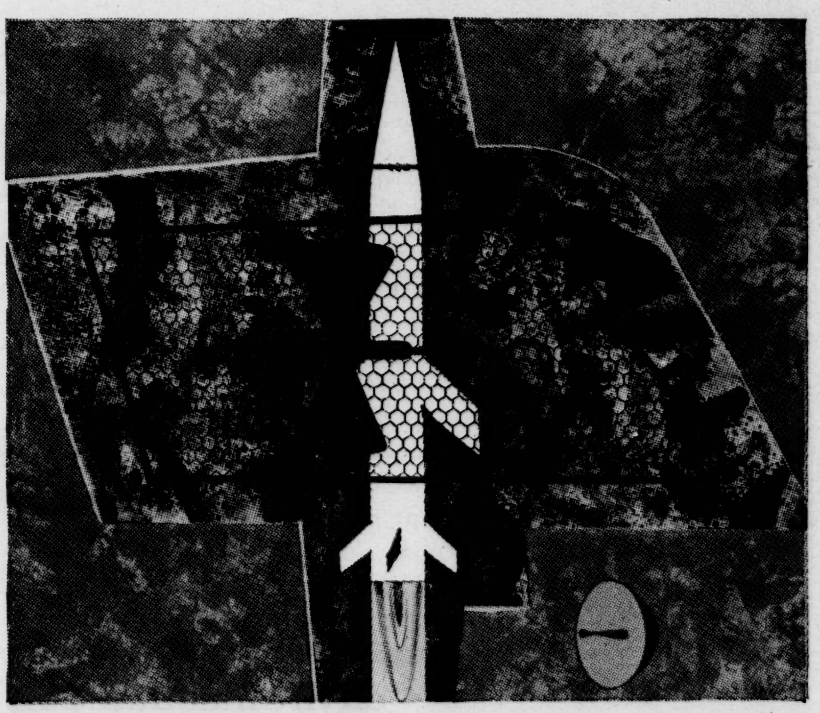


ROCKET MOTOR CASE. Brunswick's exclusive bi-axial Strickland "B" Process of fiber glass filament winding gives S-D ratio to 2,000,000, provides up to 7,500,000 psi modulus. By laying down filaments under tension, SBP excels in making cylindrical shapes, unusual contours, large range of sizes. Pre-stressing gives exactly controlled uniformity.

RADOMES. Brunswick's non-metallic materials boost heat tolerance of radomes and nose cones to 1000-1200°F for limited exposures. SBP filament winding gives highest-ever strength-to-weight ratios with significant weight savings over usual structures. With unmatched electrical uniformity, Brunswick builds to tightest tolerance for dialectric constants and compound configurations.



HONEYCOMB ASSEMBLIES now developed by Brunswick can support two million times their own weight. Brunswick research has created honeycomb assemblies of paper, fiber glass, aluminum and various combinations of these materials. Using the most advanced adhesive systems, these assemblies can be formed in compound curvatures with extremely close tolerances.

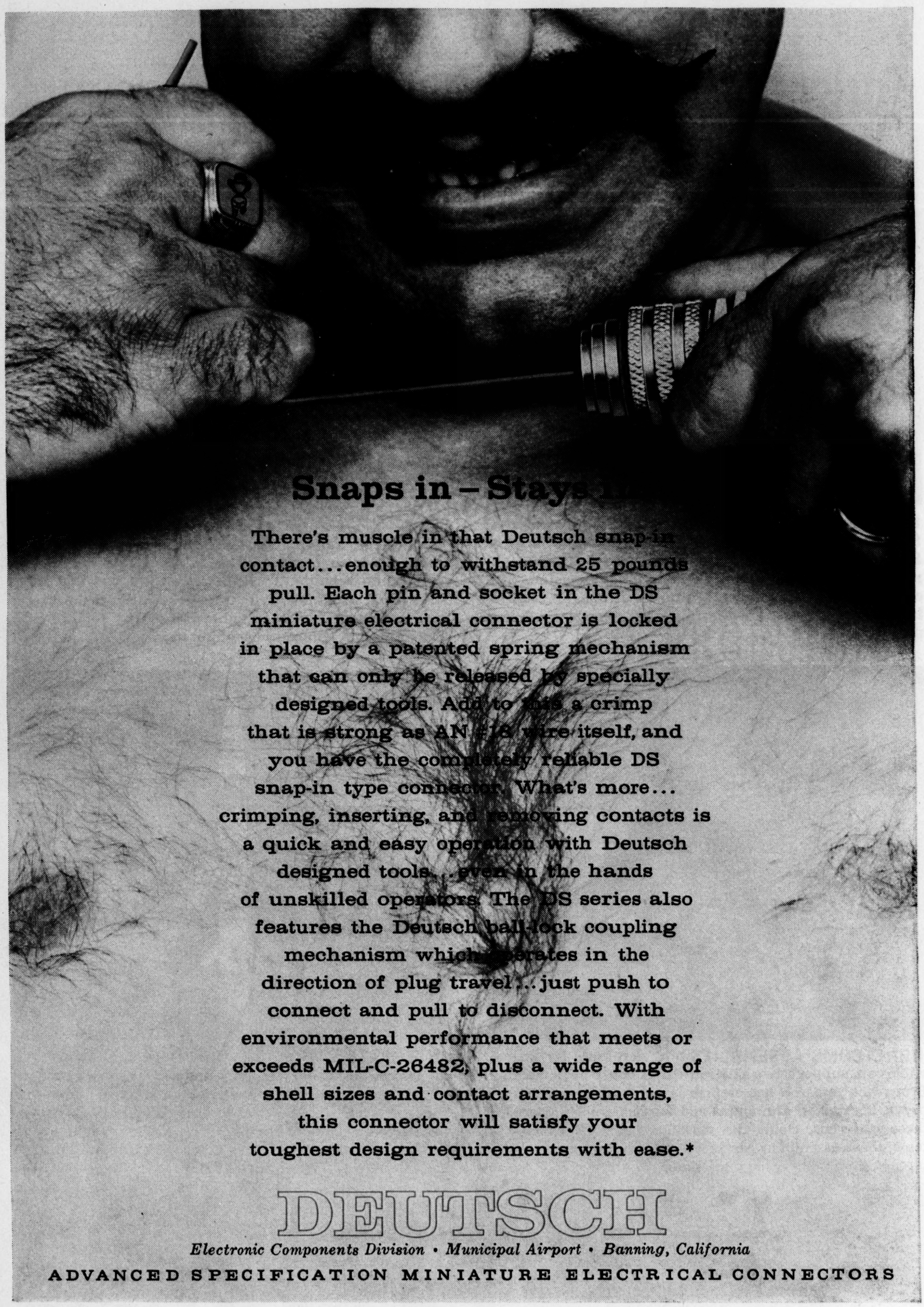


INTEGRATED ANTENNAS. Brunswick totally integrates all communications, telemetry and navigational antennas and reflectors within primary structures. No sending or receiving interference. All-plastic aircraft and missile assemblies give high weight-strength ratio, while providing aerodynamically clean lines. Can Brunswick Corporation help you in any way? Write or call today!

Interested engineers will find it rewarding to discuss career futures with Brunswick. Write or call Brunswick Corporation, Defense Products Division, 1700 Messler Street, Muskegon, Michigan.

MAKES YOUR IDEAS WORK

Brunswick CORPORATION



Snaps in – Stays...

There's muscle in that Deutsch snap-in contact...enough to withstand 25 pounds pull. Each pin and socket in the DS miniature electrical connector is locked in place by a patented spring mechanism that can only be released by specially designed tools. Add to this a crimp that is strong as AN #16 wire itself, and you have the completely reliable DS snap-in type connector. What's more... crimping, inserting, and removing contacts is a quick and easy operation with Deutsch designed tools...even in the hands of unskilled operators. The DS series also features the Deutsch ball-lock coupling mechanism which operates in the direction of plug travel...just push to connect and pull to disconnect. With environmental performance that meets or exceeds MIL-C-26482, plus a wide range of shell sizes and contact arrangements, this connector will satisfy your toughest design requirements with ease.*

DEUTSCH

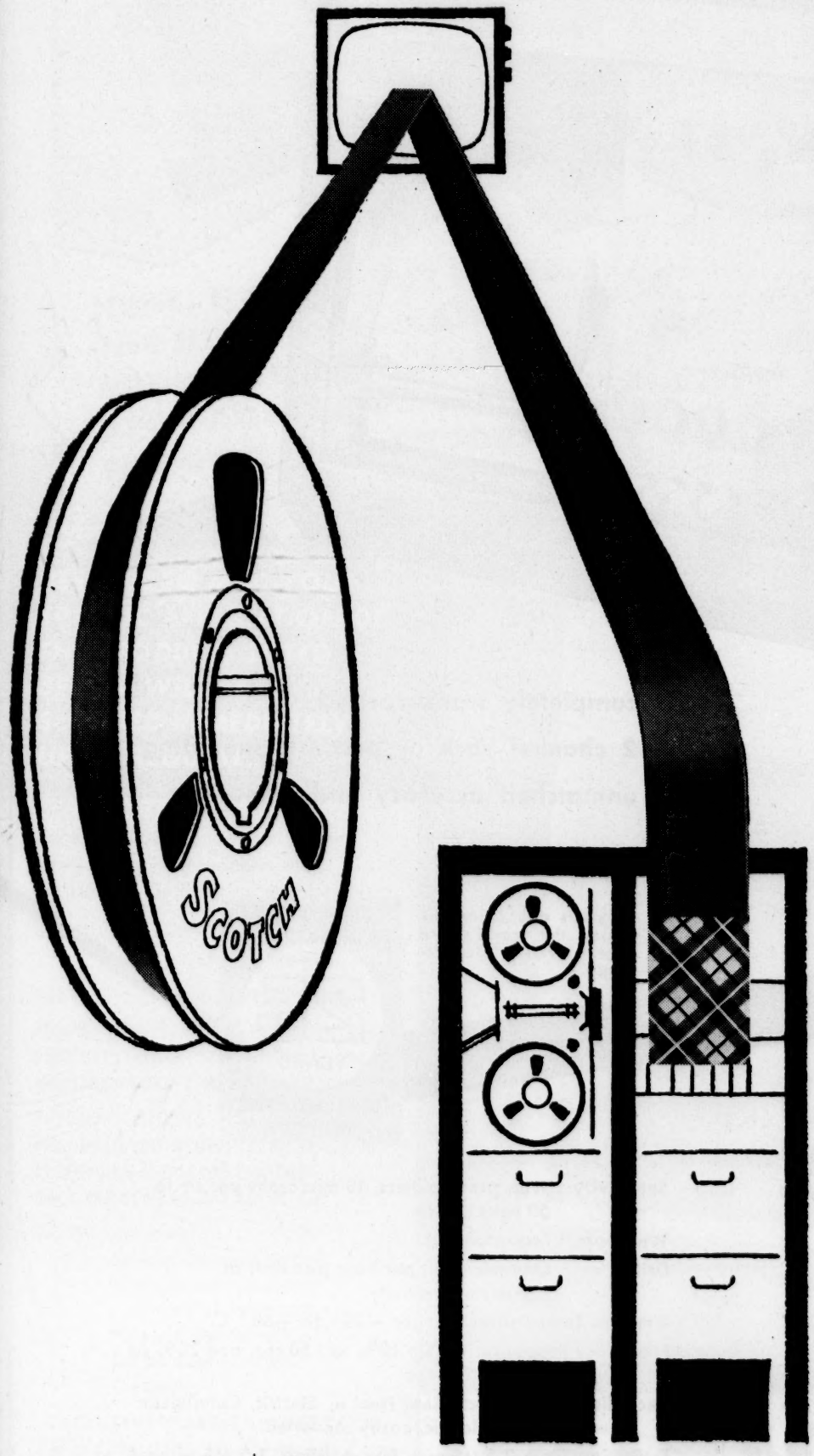
Electronic Components Division • Municipal Airport • Banning, California

ADVANCED SPECIFICATION MINIATURE ELECTRICAL CONNECTORS

***For complete information contact your Deutschman or write for Data File H-6.**

THE TAPE THAT CHANGED TV FOR ALL TIME

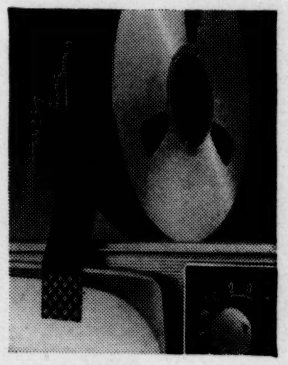
leads you right to rugged
SCOTCH® BRAND Heavy Duty Tape



THE TIE that binds television's top performer to instrumentation tape is strong—and it goes beyond the fact that the same expert team produces the best of both. "SCOTCH" BRAND Heavy Duty Tapes share a common heritage—and uncommon endurance—with "SCOTCH" BRAND Video Tape, the tape that puts a network TV show on the same "clock time" from Maine to California.

Similarities worth noting between the two: a similar high-temperature binder system, famous "SCOTCH" BRAND high potency oxides, a similar ability to resist tremendous speeds, pressures and temperatures while providing high resolution.

Let's look at the record of "SCOTCH" BRAND Video Tape and see what message it has for the user of instrumentation tape. On a standard reel of video tape like that shown here, some 1½ million pulses per second must be packed to the square inch—on a total surface area equal to the size of a tennis court. The tape must provide this kind of resolution while defeating the deteriorating effects of high speeds, pressure as high as 10,000 psi and temperatures up to 250°F.



The fact is that video tape must be essentially perfect. And it's a matter of record that thus far only the 3M experts have mastered the art of making commercial quantities of video tape that consistently meet the demands of the application.

Significantly, the high-temperature binder system developed for "SCOTCH" Video Tape is first cousin, only slightly removed, to that used in the Heavy Duty Tapes. It's this special feature that has given Heavy Duty Tapes their exceptional wear life.

The moral emerges: for tape that provides the best resolution of high and low frequencies under the severest conditions, turn to "SCOTCH" BRAND Heavy Duty Tapes 498 and 499.

They offer the high temperature binder system, plus the same high quality and uniformity that distinguish all "SCOTCH" BRAND Tapes. As the most experienced tape-makers in the field, 3M research and manufacturing experts offer tape of highest uniformity–from reel to reel and within the reel. Check into the other "SCOTCH" BRAND constructions: High Resolution Tapes 457, 458 and 459; High Output Tape 428; Sandwich Tapes 488 and 489; and Standard Tapes 403 and 408.

Your 3M Representative is close at hand in all major cities. For more information, consult him or write Magnetic Products Division, 3M Co., St. Paul 6, Minnesota.

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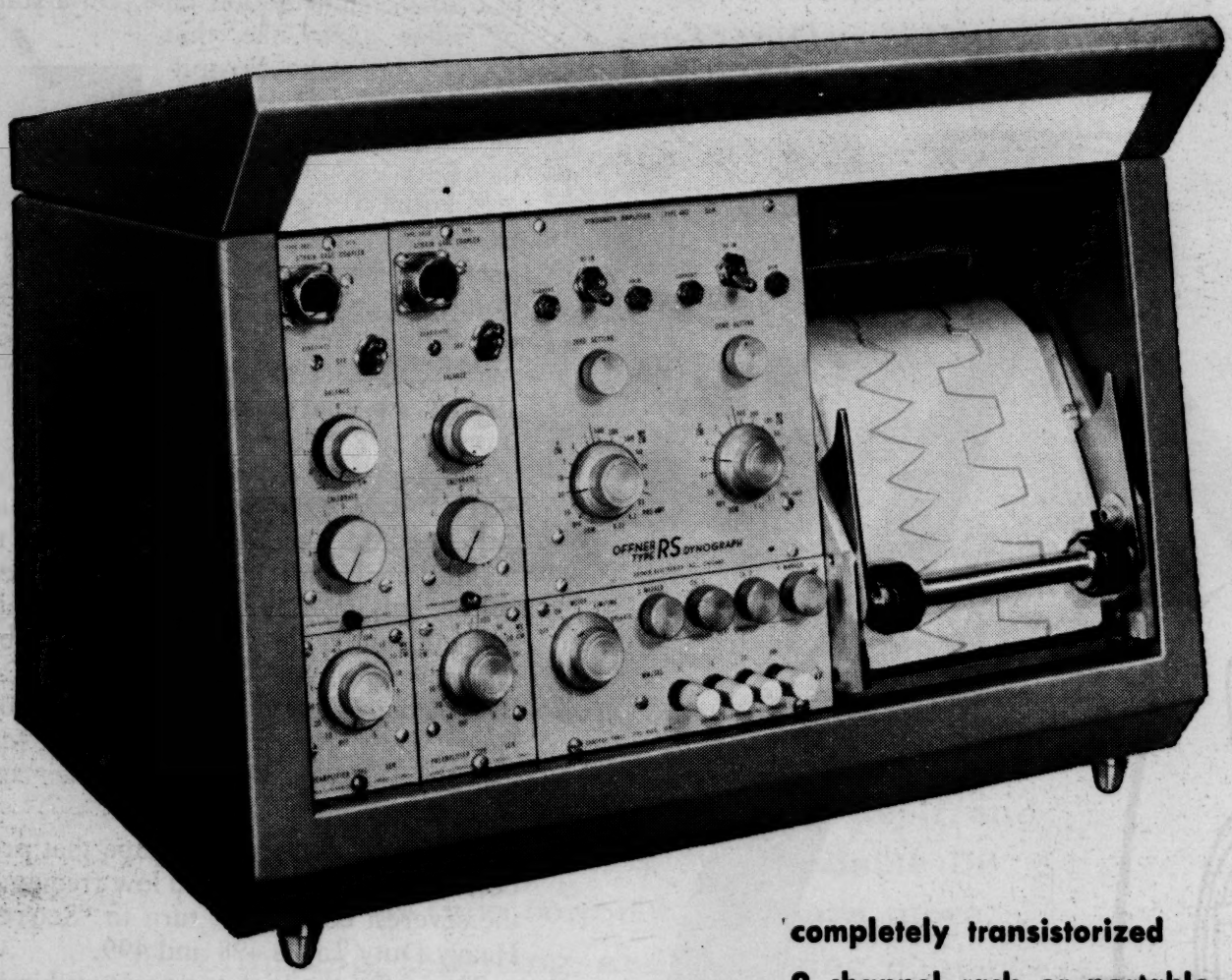

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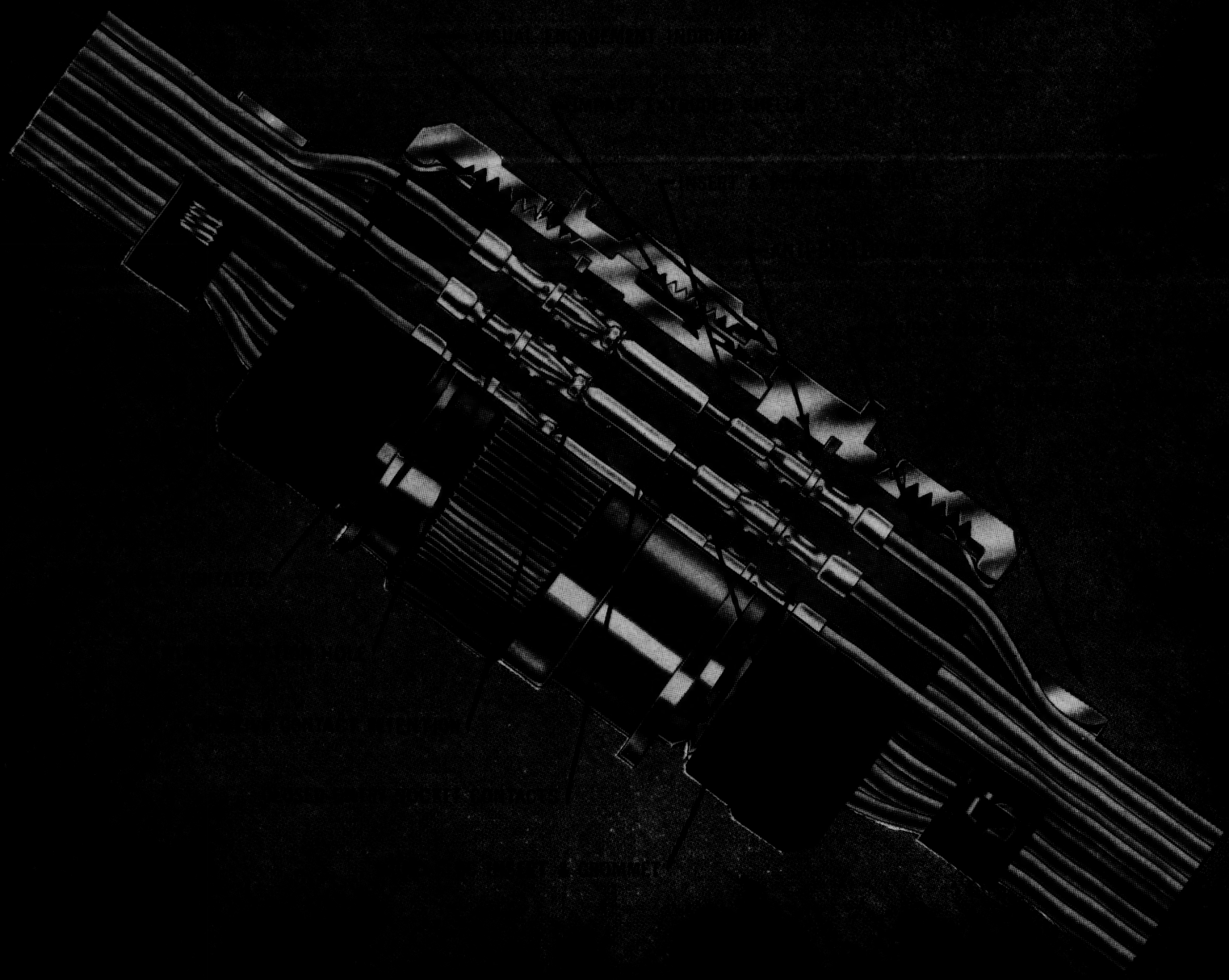

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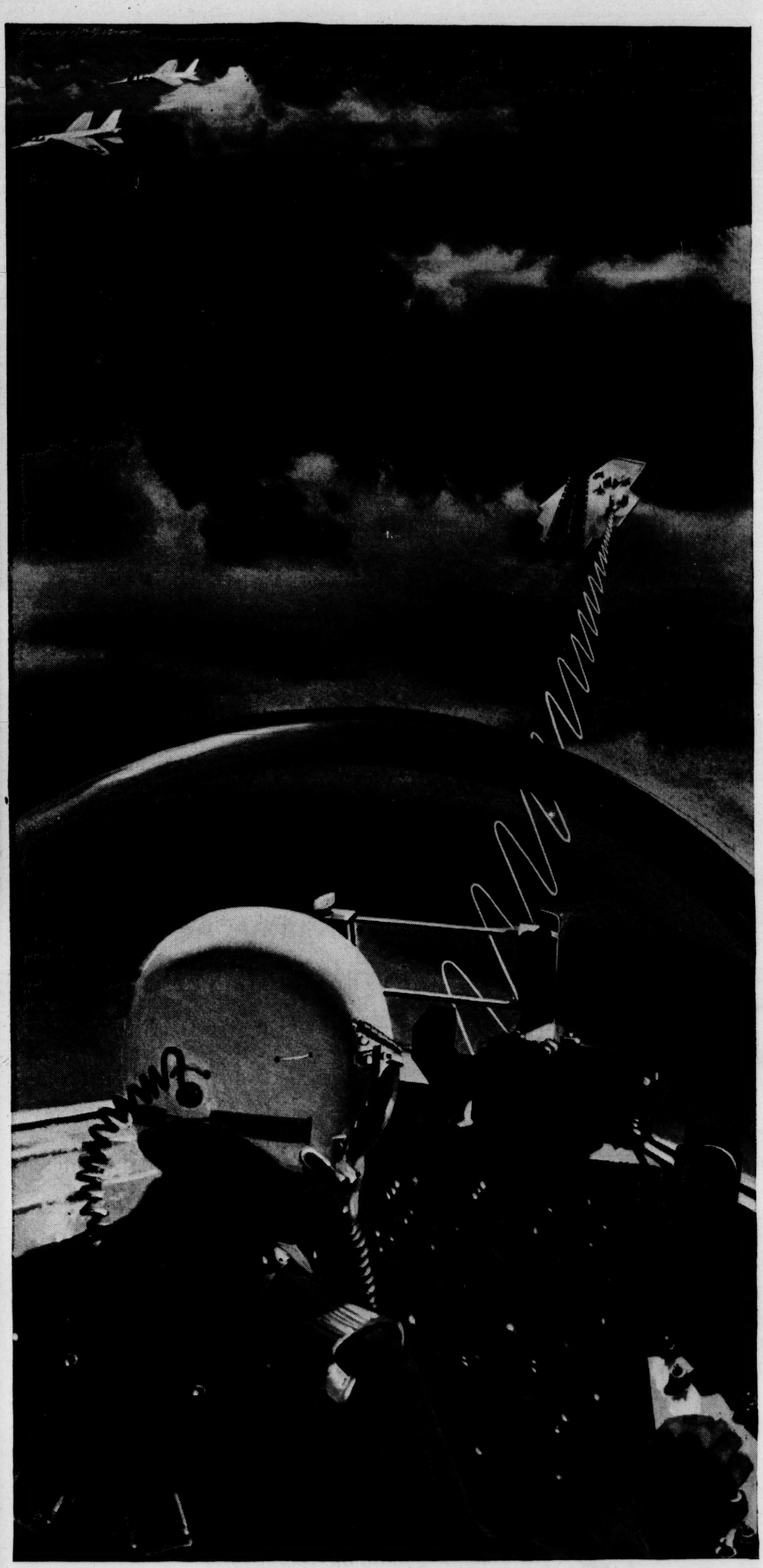

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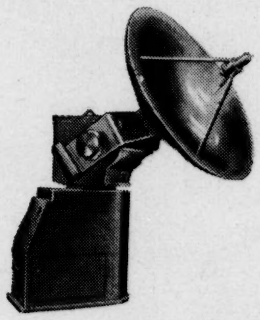

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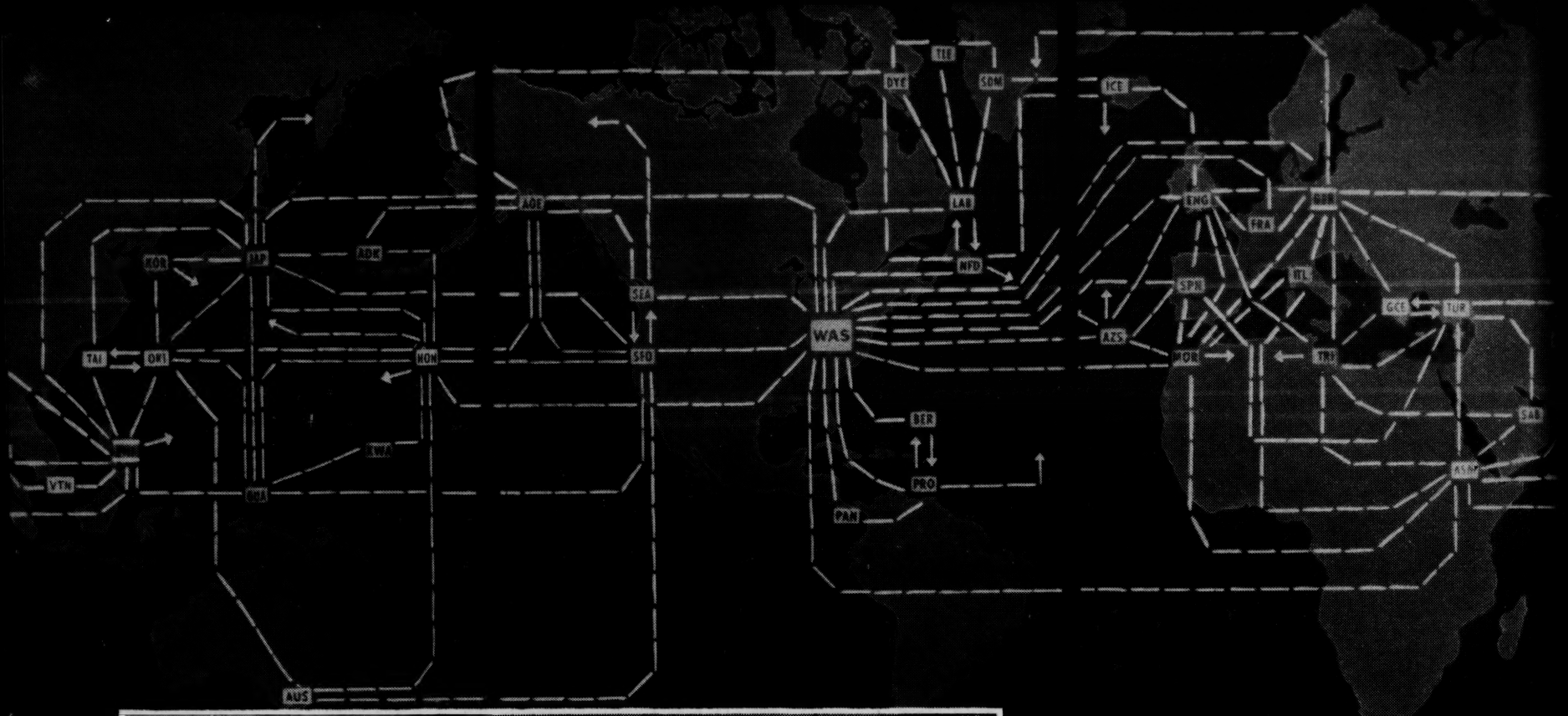

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COVER: Dassault Mystere IVs of the Patrouille de France led by Capt. Jean Brieu end their aerobatic exhibition at the 24th Paris International Air Show with an inverted bomb burst with each quartet of the 12-plane formation trailing a different-colored smoke to form a French tricolor in the air. For the correct perspective on this inverted bomb burst turn the magazine sideways with the binding on the bottom. Patrouille de France is composed of volunteer pilots from the 2nd Escadre of Dijon, French Air Force.

PICTURE CREDITS

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EDITORIAL

Comsat Decision Urgently Needed

"If the United States acts boldly and imaginatively now, the first person to be seen and heard on television screens around the world could be an American President. Otherwise the master of ceremonies at the world's first global television show probably will be Nikita Khrushchev" (AW Aug. 8, 1960, p. 21).

Today, nearly a year after these words appeared on this page, it might seem that we have indeed moved boldly and imaginatively. In the months that followed our admonition, President Eisenhower and later President Kennedy, congressional leaders and the many interested government agencies have taken steps which acknowledged the importance of a U.S. first in this dramatic use of space technology.

In industry, all of the communications common carriers who would use such a system have expressed a strong desire to see it established. The laboratories of four of these carriers already are busily engaged in related experiments.

In the aerospace industry, Bendix and General Electric are developing a military communications satellite, Project Advent, and Radio Corp. of America recently started work on an experimental civil communications satellite for the National Aeronautics and Space Administration. Philco is working on a delayed repeater-type satellite under Army sponsorship, and companies like Collins Radio and Hughes are experimenting with communications satellite techniques using their own funds.

Lockheed and General Electric, both with considerable space technology experience, boldly proposed organizing new independent companies to finance, establish and operate a commercial satellite system.

Given only these facts, one might conclude that the U.S. was certain to lead the communications satellite field. Actually, the entire program now is bogged down in conflict and controversy.

Within the ranks of the international communications common carriers, there is nearly unanimous agreement that the satellite system should be jointly owned and operated by them. But there is apprehension among some of the smaller carriers over possible domination by American Telephone & Telegraph Co.

There is disagreement between the Federal Communications Commission and the Justice Department over who should share in the system ownership. The FCC favors limiting ownership to existing international carriers, while the Justice Department urges participation by aerospace and other companies.

Even the lines of demarcation which presumably distinguish the international common carriers from the aerospace/communications manufacturers are ambiguous. AT&T's Western Electric, RCA Communications' parent company and American Cable & Radio Corporation's parent International Telephone & Telegraph Co. all have development laboratories and manufacturing capability that are being used in the aerospace field. The Sylvania division of General Telephone & Electronics Co., a domestic carrier, is in a similar position.

With this array of in-house scientific talent and production facilities, some aerospace companies are apprehensive that the carriers will retain an unfair share of the hardware production for themselves, despite broad but unspecific assurances to the contrary and FCC's firmly expressed intentions. This concern is shared by some congressional leaders and Justice Department officials.

While AT&T has acknowledged expertise in the communications-electronics field and in guided missiles, it is a comparative newcomer in the fields of space technology and satellite design. If the company must educate itself in this new technology, rather than make fullest use of existing aerospace industry capability, we will squander both time and resources.

One way to inject this aerospace technology and experience into the system design would be to allow such companies to share in system ownership. But if this is the only way in which an aerospace company can gain an audience for its ideas and assure itself of an equal opportunity to bid for hardware production, then dozens of companies will seek ownership participation and the program will bog down from sheer inertia of numbers and the pressures of corporate self-interest.

It should be possible to provide realistic safeguards to assure equality for all ideas and bidders in an open market place, without requiring each to share in ownership.

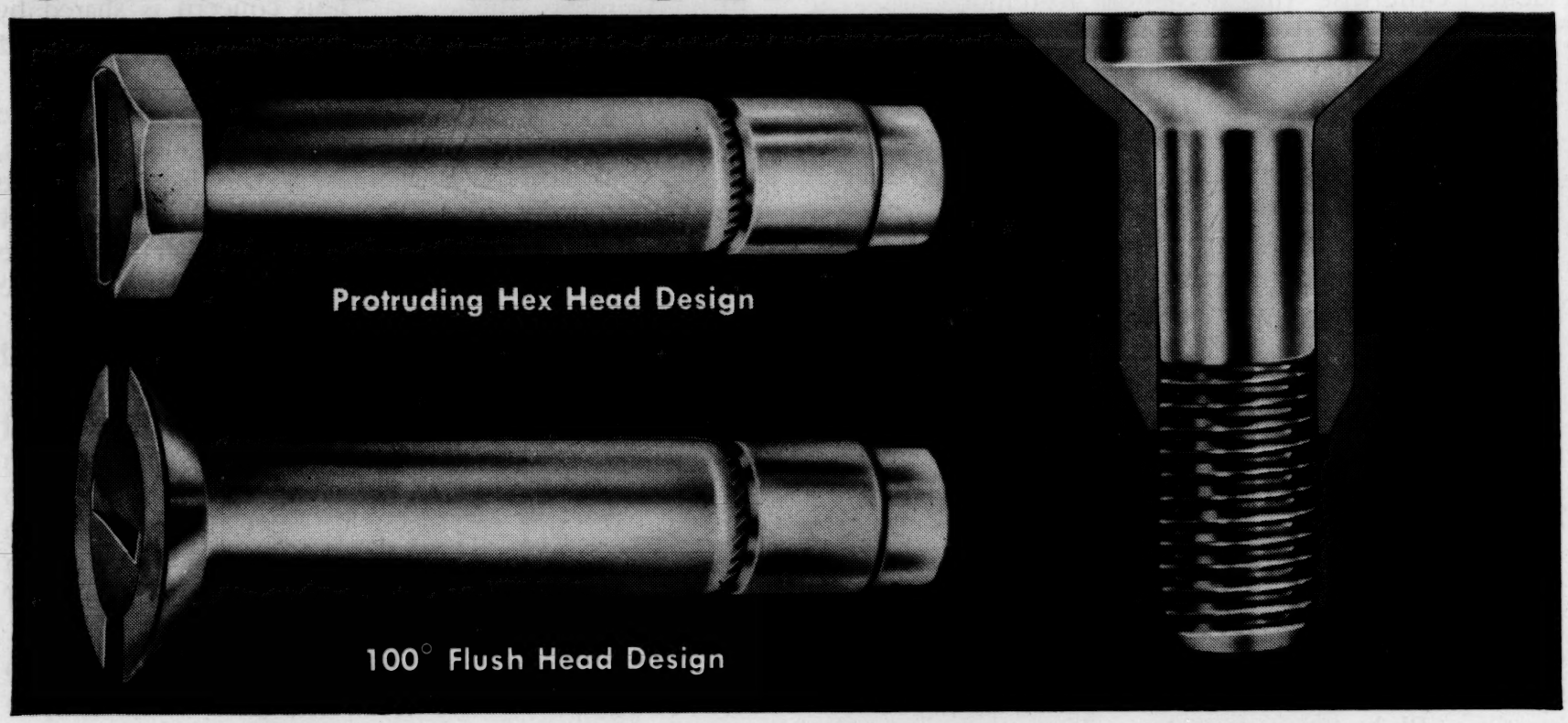
President Kennedy has now asked the National Aeronautics and Space Council to study these complex questions, which extend beyond the authority of any one department or agency, and recommend a national policy which gives highest priority to the public interest. From this study, we believe, the following principles should emerge:

- **A U.S. first in communications satellites** is a national objective that should override competitive interests of individual companies.
- **The technology is readily available now** within the U.S. to enable us to be first.
- **The system will be a showpiece for American** technology and industry, and should therefore reflect the best collective thinking that can be brought to bear. Regardless of who owns the system, its international import is too great to handicap it with design concepts of only a single or a handful of companies. It should be the product of a wide spectrum of American industry.
- **The system must be compatible** with the extensive communications facilities of the existing carriers, which means they must participate actively in system design.
- **Suitable safeguards should be provided** so that no aerospace company feels obligated to invest in the communications satellite venture, using capital needed for other purposes, merely to assure itself of an equitable opportunity to have its ideas and bids receive fair consideration.

If the National Aeronautics and Space Council can produce a speedy and sound decision to push the communications satellite program with maximum possible speed backed by the best technology, it will have taken a major step in establishing its usefulness in the face of the public skepticism that has followed it since its inception several years ago. **—Robert Hotz**

BLIND FASTENING?

SLEEV-LOCK CUTS INSTALLATION TIME IN HALF!



SPS SLEEV-LOCK blind fastener is a preassembled 3-piece shear bolt consisting of an outer sleeve with a Hi-Torque* recessed-head core bolt running through it and engaging an expansible nut.

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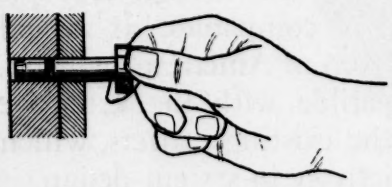
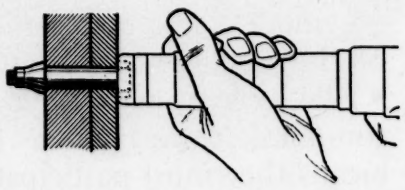
Also you can remove SPS SLEEV-LOCK blind fasteners without drilling or damage to the work. Simply run the expansible nut off the core bolt and remove the sleeve from the same side of the work on which it was originally installed.

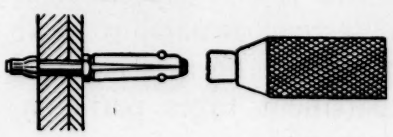
SLEEV-LOCKs are available in sizes 3/16 through 3/8 inch in .062 inch grip increments. For complete data on SPS SLEEV-LOCK blind fasteners and SPS SLEEV-LOCK power drivers and adapters, request Bulletin 2465. Write AIRCRAFT/MISSILE Division, SPS, JENKINTOWN 3, PENNSYLVANIA • SANTA ANA, CALIFORNIA.



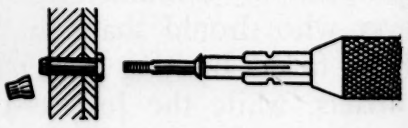
Inserting: Preassembled SLEEV-LOCK is inserted from one side of work. Can also be press-fitted in an undersize hole if desired . . . nut will not interfere.



Driving: Simple adapter on power driver holds sleeve stationary while turning core bolt, thus drawing nut over sleeve and clamping work tight.



Removing: After breaking lock by momentarily reversing driver, insert special bit in Hi-Torque recess of core bolt. SLEEV-LOCK does not have to be drilled out to be removed.



Core bolt is easily withdrawn by gripping bit with barrel-handle assembly. Sleeve is then pulled from hole with pliers or with an Easy-Out type of tool.

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WHO'S WHERE

In the Front Office

Jesse L. Jones will become vice president-general manager of the Santa Monica Division of Douglas Aircraft Company, Inc. succeeding **Leo A. Carter,** resigning to accept a special assignment with the company. **James W. Ross** will succeed Mr. Jones as general manager of the El Segundo Division.

James H. Coolidge, chairman of the board's newly formed finance committee, Thompson Ramo Wooldridge, Inc., Cleveland, Ohio. **Ernest C. Brelsford** succeeds Mr. Coolidge as vice president-finance.

J. S. Rice, a vice president, Rohr Aircraft Corp., Chula Vista, Calif. Mr. Rice continues as manager of the company's manufacturing plant at Riverside, Calif.

Roy J. Benecchi, vice president and assistant to the president, Lear, Inc., Santa Monica, Calif.

Charles M. Mooney, vice president-U. S. Defense Group, International Telephone and Telegraph Corp., New York, N. Y.

Dr. Howard H. Aiken, a director, Wac-Line, Inc., Dayton, Ohio. Dr. Aiken is director of Harvard Computation Laboratory and professor of applied mathematics at Harvard University.

Edwin D. Campbell, vice president and general manager, Laboratory for Electronics, Inc., Boston, Mass. **David A. Stuntz** succeeds Mr. Campbell as treasurer.

T. A. Barkauskas, vice president-production, and **J. R. Newcomer,** vice president-engineering, Camloc Fastener Corp., Paramus, N. J.

Gabriel C. Danch, a vice president, Western Design & Electronics Division of U. S. Industries, Inc., in charge of operations at Silver Spring, Md.

Maj. Gen. John A. Barclay, deputy commander, Army Ordnance Missile Command, Redstone Arsenal, Huntsville, Ala., retiring on June 30. **Col. S. C. Holmes,** director of industrial operations, Army Rocket and Guided Missile Agency of AOMC; **Col. Paul B. Schuppener** succeeds Col. Holmes as assistant chief of staff for research and development, AOMC. **Lt. Col. Arnold R. Thomas** has retired as chief of the weapons division of AOMC.

Air Marshal Sir Douglas Jackman, chief coordinator of the Anglo-American Community Relations Scheme in the United Kingdom, succeeding **Air Marshal Sir Richard Atcherley,** retiring.

Alan L. Dean, deputy administrator for administration, Federal Aviation Agency, Washington, D. C., and **Lee E. Warren,** deputy director, Bureau of Air Traffic Management.

Honors and Elections

Dr. Ta Li, senior staff scientist at General Dynamics/Astronautics, has been named an associate fellow of the Institute of the Aerospace Sciences.

Peter N. Jansen, special assistant to the senior vice president of The Boeing Co., has received the 1961 Greer Award for "contributions to maintenance and product support in connection with activities for the Department of Defense."

(*Continued on page 114*)

INDUSTRY OBSERVER

▶Aerojet, Rocketdyne, General Electric and Pratt & Whitney have made informal, unsolicited proposals to National Aeronautics and Space Administration for development of a 1-million-lb. thrust liquid oxygen-liquid hydrogen rocket engine.

▶NASA Marshall Space Flight Center may award a $150,000 contract for a 15,000-man-hour study for a Nova vehicle offshore launch facility by June 30 in order to finance it with Fiscal 1961 funds (AW June 19, p. 32). This offshore approach may prove so expensive that an isolated land area, such as Florida's Everglades, might be considered as an alternative.

▶Immediate assignment of an Air Force test pilot to the North American B-70 flight test program has been recommended as the result of an Aeronautical Systems Division survey of B-70 weapon system management. Size of the role USAF will have in initial flight testing of the aircraft is still to be resolved (AW Apr. 17, p. 31).

▶Recent test firing of a United Technology Corp. solid rocket configuration involved a mass ratio of about 0.94 and propellant specific impulse of approximately 270. Test unit for the company-funded project had about 800 lb. of propellant, a rubber-type insulator and glass fiber-wound case.

▶Navy Bureau of Ships is expected to award three parallel study contracts for airborne data processing equipment and display systems for coordinating anti-submarine warfare. Systems would be capable of accepting a variety of inputs and handling detection, acquisition, tracking and decision making.

▶General Electric's Flight Propulsion Division is working on a family of highly advanced engines based on component design developments under its X-370 program. Effort covers both study and development of engines for use over a great range of Mach numbers and probably is aimed at a one-stage-to-orbit vehicle such as USAF's proposed Aerospace Plane.

▶NASA unofficially favors use of a radioisotope thermoelectric generator for both power and heat on the last four of seven projected Surveyor lunar soft-landing spacecraft. Final decision may require consultation with other government agencies on national policy and lunar contamination aspects. One problem is that the isotope must be ordered nine months in advance. NASA currently isn't certain the power system will be ready and thus hesitates to order the isotope.

▶Trident is a Navy research and development project aimed at developing equipment for ocean surveillance from shore. It includes projects Fishbowl, an active system; Caesar, a passive system, and Artemis, a long-range sonar detection system.

▶Air Force has asked for $17 million in Fiscal 1962 for procurement of the AN/GLR-1 ground-based electromagnetic reconnaissance system which will form part of its 466-L electromagnetic intelligence support system.

▶Model of NASA's Sunflower erectable solar collector for a space vehicle electric power system is scheduled to be flown in about a year as an Argo D-4 payload. Test flight will be made from Wallops Island, Va.

▶Latest Air Force estimate of the cost of developing, fabricating and installing Strategic Air Command Control System 465-L, including four hardened command control sites, is $355.2 million, a substantial increase over last year's estimate of $237.9 million. Fiscal 1962 request for $53.5 million provides for hardened control centers at SAC headquarters and at March AFB, Calif.

▶Scaled-down Project Artemis tests were moved out of the harbor at Long Beach, Calif., after the sound waves generated killed a large number of fish and drove longshoremen and shipyard workers out of ship hulls. Project Artemis involves tests of a transducer suspended under a ship to produce high-intensity sound for long-range sonar detection of submarines.

In the minds of GCR researchers, the moon is always up there, big and challenging. They see space stations, too. And Venus and Mars—and further. These visions are linked with the exciting realities of their work in solid propellants and propulsion systems: multi-million-pound-thrust segmented boosters; nitroplastisol and rubber-base propellants; hybrid rockets; and much more. GCR researchers use the most advanced tools available—including the new million-dollar lab shown below. And they can see their ideas brought to life and put to the test on the spot in GCR's modern manufacturing and testing facilities.

GRAND CENTRAL ROCKET COMPANY
REDLANDS, CALIFORNIA

THE MOON
NEVER SETS
IN REDLANDS,
CALIFORNIA

Washington Roundup

Dyna-Soar Hopes

Air Force's hopes for expansion of the Dyna-Soar boost glide project are growing. Chief opposition to making it a weapon system program rather than a research and development effort has come in the recent past from Dr. Herbert York, former director of research and engineering for Defense Department, from USAF Under Secretary Joseph Charyk and from the National Aeronautics and Space Administration, USAF's technical partner in the project.

York has now left the Pentagon. The attitude of his successor, Dr. Harold Brown, is not clear yet. Charyk, a holdover from the previous administration, has helped Air Force through the transition stage and some observers believe he may be leaving soon. NASA's objections are not strong enough that they couldn't be overcome if Defense decides a weapon system is the better approach.

In addition, the new USAF Chief of Staff, Gen. Curtis LeMay, is understood to favor a more ambitious approach and Lt. Gen. Bernard A. Schriever, whose Air Force Systems Command has the development responsibility for Dyna-Soar, has always favored a much more rapid program pace (see p. 28).

Watch for Gen. Orval Cook (USAF, ret.) to retire as president of the Aerospace Industries Assn., shortly. AIA will abandon its past practice of hiring a top-ranking retired Navy or Air Force officer and bring in a new president with considerable experience in the aerospace industry.

When Charles Hitch, Defense Department comptroller, set out to determine the eventual costs of each current and proposed military program, he indicated it could be done without substantially increasing the size of his office.

There now are complaints in the Pentagon that his efforts have already required longer hours and may require additional help both in the comptrollers' offices of the three services and in the offices to which the comptrollers must go for their information. Hitch and a number of his assistants are working 11-hr. days.

Supersonic Study

Task group to study the military requirements for a supersonic transport has been formed by the Office of Defense Research and Engineering. It will look at possible missions, structure and engines, and it hopes to include representatives from other government units including the Federal Aviation Agency.

Private pilots who are being squeezed out of landing fields are finding a champion in FAA Administrator Najeeb Halaby. He calls them "citizens of the air" and has pledged to try to get communities and even states together on building common airfields for them. Following a questionnaire survey of 300,000 pilots, Halaby has held six "air share meetings" with private pilots to see how FAA can help them.

Smooth political liaison work is earning the National Aeronautics and Space Council a good reception on Capitol Hill. The council, headed by Vice President Lyndon Johnson, got all the $320,000 it asked for Fiscal 1962 from the House and no cut is expected in the Senate.

Executive Secretary Edward C. Welsh has pledged to keep the staff small and use science advisers already in government rather than hire new consultants. He coordinated President Kennedy's recent request for increased space funds, helped create bipartisan support for it by consulting with key congressional Democrats and Republicans at each step as he put the package together.

Yo-Yo Returns

Navy's idea for a single-pass reconnaissance satellite, which received little attention when it was first proposed as Project Yo-Yo more than a year ago now has been made into a project by Defense's Advanced Research Projects Agency. At one time the plan was to boost the Yo-Yo satellite with the Sea Scout, a vehicle using Polaris solid-fuel engines topped by NASA Scout upper stages. However, Air Force may be assigned the job instead of the Navy, which could change the booster. Navy's Early Spring anti-satellite "space mine" concept also is receiving serious attention.

Weather forecasting, with special emphasis on the potential of meteorological satellites, will be looked into soon by the House space committee. Forecasting now involves the Weather Bureau, Federal Aviation Agency, NASA, the military services and other agencies. Senate appropriations subcommittee decried this duplication when it reviewed the FAA budget. In defense, FAA said it has a study under way that should lead to a single, integrated national aviation weather system in two years.

High-energy liquid propellant upper stage that will be developed for use on the Titan II as a backup vehicle for Advent satellite launchings is nicknamed Project Chariot. Because USAF Under Secretary Joseph Charyk has given strong support to the proposal, it also is referred to as "Charyk's Chariot."

—Washington Staff

Agreement Reached on USAF Solids Role

Defense-NASA pact formally marks Air Force return to major booster program, opens door for expansion.

By Edward H. Kolcum

Washington—Defense Department and National Aeronautics and Space Administration reached an agreement last week which makes formal the return of the Air Force to the national space booster development program and opens the door for a possible major expansion of the USAF role in the U.S. space effort.

The agreement gives the Air Force technical responsibility for development of the solid Nova, which must be done to NASA specifications. USAF is not limited to NASA requirements, however, and is expected to add its own funds to the large solid motor development program.

How much of a wedge this will give the Air Force in expanding its space mission depends largely on:

- **Success of the large solid** motor program, compared with the success and timing of the NASA-Rocketdyne 1.5-million-lb. thrust F-1 liquid engine.
- **Assignment of military missions** to the large solid, such as the Dyna-Soar weapon system which now is expected to be heavier than 25,000 lb.

Although the liquid and solid Nova developments are called parallel programs, they are expected to become increasingly competitive within the next few years until a decision is reached on which propellant to use for the Nova booster. If the solid is chosen, the Air Force will provide engines to NASA for its Apollo manned lunar landing program.

More important to the Air Force is the fact that Nova is its first opportunity since it lost its booster programs to NASA in 1959 to get into development of a propulsion system which does not have a specific military mission. Recently expanded role of the USAF Systems Command improves the chances that the new launch vehicles will be given military missions. Systems Command is growing from 45,000 to about 75,000 personnel, it has been given procurement responsibility for missiles and aircraft, and its commander, Lt. Gen. Bernard A. Schriever, is being promoted to four-star rank.

Nova's Value

Solid Nova booster motor, to be designed to launch at least 150,000 lb. to escape velocity, also gives the solid rocket industry the opportunity to substantiate claims of the high potential of the propellant (AW Mar. 20, p. 50). Two companies are expected to be chosen for early development phases of the large solid motor.

Deputy Defense Secretary Roswell L. Gilpatric recently told Congress that the liquid-solid Nova booster choice can be made by 1964 (AW June 12, p. 35), and Defense Secretary Robert McNamara has predicted large solid rocket development could grow into a $500-million program (see box).

Possible C-3 Role

Solid propellant proponents see the solid Nova as a parallel not only for the liquid rocket Nova, but also for the newly-conceived Saturn C-3 (AW June 19, p. 26). Both the liquid Nova and C-3 are based on the Rocketdyne F-1 powered first stage, and one solid advocate believes that if a decision on liquids and solids has not already been reached, the solid Nova booster has a chance to be the C-3 booster.

Among the broad requirements NASA is considering as specifications to the Air Force for the solid Nova motor are:

- **Maximum dynamic pressure** of 1,000 psf., which Robert Wasel of NASA's solid rocket office terms the critical design point since the vehicle must be built for an abort at maximum dynamic pressure.
- **Maximum liftoff force** of 8g. A maximum dynamic pressure force of under 1,000 psf. will keep liftoff forces under 8g.
- **Burning time of 85-100 sec.,** a parameter which governs dynamic pressure since increased burning time decreases these forces. One industry representative estimates that the large booster could have a 125-sec. burning cycle.
- **Specific impulse** and mass fraction ratio are not specified, but current technology is believed to be sufficient in these areas.

Wasel said he does not believe any new technology is needed for the solid Nova except in developing an attitude control. Aerojet-General studies for the Air Force indicated that nozzles can be scaled upward to accommodate large motors, and the problem of nozzle erosion decreases as the size of the nozzle increases, he said.

William Cohen, chief of NASA's solid rocket programs, said the agency is seriously considering these solid Nova configurations:

- **Three-stage,** generally favored at this point because it would be simpler to design. It would consist of an eight-motor cluster of 1.25-million-lb. segments as the booster stage. Each segment would be about 13 ft. in diameter

Large Solid Booster to Cost $500 Million

Washington—Total development cost of Air Force's new large solid propellant booster program—scheduled to be initiated in Fiscal 1962 with $62 million—is estimated at $500 million, according to Defense Secretary Robert S. McNamara.

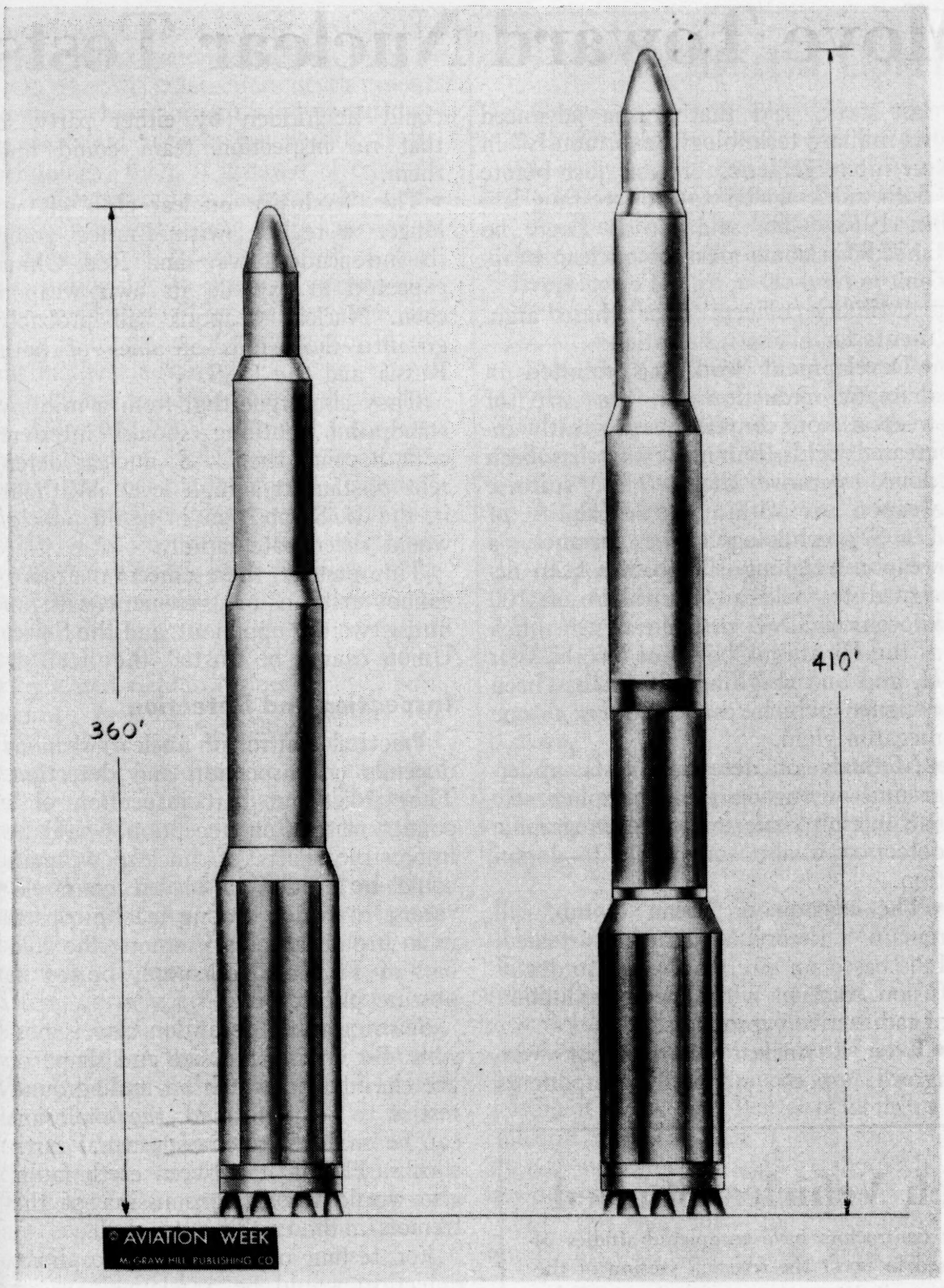
McNamara told the House appropriations committee that four contractors probably will be invited to submit proposals for the booster, with two selected for "preliminary work." After this preliminary work is completed, he said the field will be narrowed to one contractor. McNamara's testimony was released last week.

Maj. Gen. Robert J. Friedman, USAF budget director, later explained that a program applying the large solid booster to vehicles for military space use would bring the cost to $1.5-2 billion. Military applications have been anticipated in USAF's Project Phoenix study (AW Mar. 27, p. 50).

"Depending on the number of stages or items to be boosted," Gen. Friedman commented, "programs could bring it beyond that" $2-billion figure. He said that for upper stages with the solid propellant booster, Air Force technical experts "would go toward liquid propulsion."

The President's request to initiate the program, now pending in Congress, includes $50 million for the booster development, plus $12 million for support facilities. The test stand for the booster vehicle, Gen. Friedman noted, would have to have a clearance of 25 to 30 mi., since the booster's noise level would shatter glass within this area.

Gen. Friedman also disclosed that the Air Force probably will initiate work on its program for an improved upper stage rocket for the Titan II launch vehicle with Aerospace Corp. (AW June 12, p. 32). USAF studies show that there are about five possible approaches to this project, he said. The President has requested a supplemental budget of $15 million for Fiscal 1962 to initiate it.



PRELIMINARY CONFIGURATIONS of the solid rocket Nova include one four-stage vehicle with solid first and second stages, and one with three stages. Top two stages on both would be liquid hydrogen-liquid oxygen engine clusters. Vehicle is a parallel development to the liquid F-1 rocket program, and it will be designed to launch more than 150,000 lb. to escape velocity for the Apollo manned lunar mission. Nose sections, which contain payloads, are not counted as stages. Three-stage version is shown at left.

and 120-ft.-high. Total booster stage would weigh 10 million lb. and liftoff thrust would be 20 million lb. Second and third stages would be liquid hydrogen-liquid oxygen clusters, probably of the Rocketdyne J-2 which develops 200,000-lb. thrust.

• **Four-stage,** a booster cluster of seven segments, 13 ft. in diameter and about 100-ft.-high. Second stage would be a cluster of three or four solid motors, and the two upper stages would be the same as in the three-stage configuration.

Another concept, which has not been as fully studied, is a two-stage configuration. The booster would consist of six 100-ft. rockets wrapped around a hydrogen-oxygen engine. Second stage would be another hydrogen-oxygen engine.

Maximum diameter of any of the configurations is 45 ft., Cohen said, which is about 20 ft. less than the diameter of a liquid Nova cluster of eight F-1 engines (AW June 19, p. 32).

Broad design requirements, which are preliminary and could change, resulted from a month-long study by NASA scientists and voluntary advice from most of the solid rocket companies in the country.

One major difficulty in the parallel Nova programs is the cost and time required to develop and build launch facilities. Cohen would like to see construction started immediately on a single complex which could handle either solid or liquid Nova vehicles, even though design work would be complicated.

New Science Office Urged in White House

Washington—President Kennedy was advised last week in a Senate staff report to establish a White House Office of Science and Technology to help plan the nation's scientific effort.

Chairman Henry M. Jackson (D.-Wash.), endorsing the report prepared by the staff of his Senate Government Operations National Policy Machinery Subcommittee, said President Eisenhower's appointment of White House science advisers was a "forward step" but "the time has come to build upon this advance."

The report recommended making permanent the post of special assistant to the President for science and technology and the President's Science Advisory Committee.

The special assistant to the President for science and technology would head the new Office of Science and Technology. The office, according to the report, would be "a staff unit for helping the President look ahead and pull together in science and technology." The director of the office should have two deputies, the report said.

Nimbus TV to Have Resolution of 0.1 Mi.

Cape Canaveral—Three videcon cameras in the second-generation Nimbus weather satellite payload will cover a large area of the earth's surface with a resolution of 0.1 mi., according to Robert Golden of Goddard Space Flight Center.

The 650-lb. Nimbus package is scheduled to be launched next year by a Thor Agena B into a circular 600-mi. polar orbit from the Pacific Missile Range. Golden told the Cocoa, Fla., chapter of the Institute of Radio Engineers that the solar paddles will have the capability of switching the system from videcon to infrared during the night, and the infrared camera will have a 0.3-mi. resolution.

The satellite will make 13 orbits daily, and will be interrogated by the primary station in Fairbanks, Alaska, nine times a day. The system will be designed to store 40 pictures per orbit.

A gyro system will be used for pitch synchronization to provide continuous orientation of the cameras toward the ground. Horizon scanners will check the vertical alignment, and corrections will be made by reaction jets.

Camera system for 114-mi.-high Nimbus also contains a medium-resolution infrared experiment to measure the earth heat budget, and a low-resolution infrared radiometer to sample daytime cloud radiation.

U.S., Soviets Move Toward Nuclear Tests

Washington—Resumption of nuclear weapons tests by the two great nuclear powers appeared certain last week as pressure for testing mounted in the U. S. and Soviet Premier Nikita Khrushchev warned that Russia will begin tests "immediately" if the U. S. ends its three-year voluntary moratorium.

President Kennedy has warned Russia that the U. S. might be forced to resume tests if agreement on an international ban is not reached soon. Premier Khrushchev, appearing in his wartime lieutenant general's uniform at a Kremlin meeting marking the 20th anniversary of Germany's invasion of Russia, said "many new devices have been worked out that require practical tests." He said other weapons need improving and said if Russia failed to test while the western powers do, "we would cause harm to the defense ability of our own country."

U. S. arguments—chiefly from the military services and the Joint Congressional Atomic Energy Commission—offer the same reasons why the U. S. should resume tests and add the further point that Russia may now be testing in secret, since no detection system is foolproof.

Sen. Henry M. Jackson (D.-Wash.), commenting after his subcommittee on military applications of atomic energy heard the Joint Chiefs of Staff in secret last week, said that Russia advanced its military technology "enormously" in an intensive series of tests just before both sides agreed to stop testing late in 1958. He said Russia "may be ahead" in some areas of nuclear weapons.

Military officers offer these arguments for a test resumption:

- **Development work has resulted** in dramatic reduction in the size of weapons, or, conversely, in greatly increased yields, but no testing has been done to prove them. The "suitcase weapon" is within the capability of U. S. technology. For instance, a weapon weighing 100 lb. has been designed to yield an equivalent of 100 kilotons of TNT, or five times as much as the Hiroshima bomb of World War II, and one weighing 600 lb. has been designed which can produce a one megaton yield.
- **Methods of detecting tests** underground or outside the atmosphere are still in embryonic stages. Seismographic detection is also susceptible to deception.
- **The neutron, or "clean" bomb,** will remain a theory until actually tested. It is based on a relatively high order of fusion reaction with lower production of radioactive byproducts.
- **Even if nuclear disarmament** were agreed upon, weapon components could be hidden by either party so that no inspection team could find them.
- **The "exclusive nuclear club"** is no longer a reality, with France going its independent way and Red China expected to explode its own weapon soon. Nuclear weapons will probably go into the hands of allies of both Russia and the U. S.

They also argue that from a military standpoint, nothing should interfere with keeping the U. S. nuclear deterrent posture at a high level. Without it, the U. S. position in world politics would deteriorate rapidly.

This posture, these officers maintain, cannot rest on an agreement with an untrustworthy opponent, and the Soviet Union cannot be trusted, they feel.

Inspection and Detection

Practical control of nuclear weapons depends on inspection and detection. They point out that inspection of a country intent on deception would be impossible. Parts of nuclear weapons could be hidden in loaded grain elevators, in mines, among machine parts in an industrial factory, among the gold bars of Ft. Knox, or simply buried in obscure places.

Seismographic deception also is possible. By varying the size and shape of the chamber in which an underground test is to be performed, the explosion can be made to resemble natural earth shocks. Placing it between earth faults also would shield transmission of the tremors in the earth's outer shell.

For testing outside the atmosphere, detection would be a relatively easier task. The U. S. already has an over-all detection program in Project Vela. Vela Hotel is the portion of this project devoted to space detection (AW Nov. 14, p. 29).

The first stage in this program has featured 25-lb. piggyback packages carried on ICBMs in test flights. Natural radiation has been measured in this series at altitudes up to 500 naut. mi.

Packages flown with Air Force Blue Scout rockets are designed to go to altitudes varying between 3,000 naut. mi. and 30,000 naut. mi. These flights are planned to last until 1963. They are of limited value, however, since high altitude nuclear bursts are prohibited as part of the moratorium and no data can be obtained on nuclear explosions.

For detection experiments in deeper space, satellites weighing 278 lb. are to be boosted into highly elliptical orbits by launch vehicles with an Atlas D first stage and Agena B second stage, with apogees of 90,000 naut. mi. and perigees of 350 naut. mi. This will likewise provide only background radia-

New Dyna-Soar Launch Vehicles Studied

Washington—Air Force and its Dyna-Soar contractors have completed studies of five different rocket vehicles that could be used to boost the research version of the glider into orbit under Step 2A and then turn it into a weapon system with an initial operational capability under a proposed new Step 2B.

Step 2 now covers only orbital research flights. Depending on their favorable outcome, USAF would seek approval for Step 3, which calls for a manned weapon system much larger and heavier than the research glider and requiring an even larger booster.

Air Force Systems Command's Space Systems Division will turn its studies over to command headquarters soon. The Boeing Co., prime contractor for the glider, also has studied the booster possibilities. They include:

- **Martin Titan II missile with solid rockets clustered around the sides of the first stage. Solid rockets would serve as the first stage. Liquid-fueled Titan engines would be ignited in the air.**
- **First stage of the Titan II with a new high-energy upper stage adapted from the Saturn S-IV stage, which uses liquid hydrogen.**
- **First stage of the Titan II with a new upper stage based on the 200,000-lb. thrust liquid hydrogen J-2 engine, which will power the Saturn S-II stage.**
- **Combinations of the Saturn S-II and S-IV stages.**
- **Current version of the Saturn C-1 vehicle, which includes the S-I, S-IV and S-V stages.**

The Saturn C-1 is expected to be favored by Systems Command because it provides a greater weight-lifting margin than the other vehicles studied. Since the command still is anxious to increase the Dyna-Soar effort from a research program to a full-fledged weapon system program, this margin assumes even greater importance.

Under proposed acceleration of the program, a hurry-up version of the glider could be flown as early as the end of 1962 or early 1963. Step 1, which is the sub-orbital flight phase, probably will include five vehicles.

tion observations, with no nuclear explosion measurements possible.

On the Vela detection development program, the argument is advanced that Russia could keep in touch with U. S. technology, then, if accused of exploding nuclear weapons, categorically deny any such testing, using their knowledge of detection shortcomings to show that it is impossible to prove a weapon has been exploded. The military services claim resumption of testing would result in these advantages:

- **Much has to be learned** on the fusion, or hydrogen, bomb. By using tritium, an isotope of hydrogen, these explosions can be made much "cleaner" through experimentation. Thus, relatively less contaminating materials would be released, with relatively more material going into energy. This is basically the approach to the so-called neutron bomb.
- **Increased yield in fusion bombs** would permit carrying more weapons in B-52, B-58 and B-47 bombers and would pack more power into the warheads of the Atlas, Titan and Minuteman ICBMs and the Polaris fleet ballistic missile.
- **Further reduction in size** of tactical nuclear weapons, which are fission bombs based on uranium 238 and plutonium, increasing their versatility. These weapons are basically "dirty," or highly contaminating. Further testing would reduce this undesirable feature. One variation of the fission bomb would have uranium 235 aiding in the super compression of ordinary uranium 238, causing its explosive disintegration. This much less expensive material will not explode under the compression of ordinary explosives.

Berlin Corridor Control

Geneva—Control of air corridors, communications and airline passenger lists of all aircraft flying into Berlin, plus the probable closing of Tempelhof Airport, would follow any peace treaty between East and West Germany, according to Walter Ulbricht, chairman of the East German Council of State.

Speaking before an East Berlin assembly, Ulbricht said Tempelhof should be closed, with all traffic flowing into East Berlin's Schonefeld Airport. Noting that Tempelhof is located in the heart of the West Berlin, he added:

"It is in the interest of the West Berlin population to eliminate the noise from aircraft over the city and the danger of a crash in built-up areas such as the one in Munich [by a USAF C-131] not so long ago.

"Perhaps Tempelhof will quietly peter out on its own once an agreement is reached on the reorganization of all air traffic to and from Berlin in general and on air safety services in particular. We are ready to discuss the question of air security with representatives of the responsible state and are awaiting their suggestions."

Asked whether East German demands for control of all air traffic into Berlin automatically includes supervision of all passenger lists, Ulbricht replied:

"I presume you are acquainted with international procedure and the sovereign rights of individual nations as far as traffic of any description is concerned. . . . Whether people enter our territory by land, water or air, they are all subject to our control and our laws."

He added that, with Schonefeld the only Berlin commercial airport, "communications would then be controlled by us and whoever abused them would be forced down."

In answer to a question concerning the West's probable reaction to such moves, he said the Communist government has "examined this question, and we do not believe that Western powers would risk any act of agression against us."

Concerning the political implications of the various weapons, some military officers say that the tactical nuclear weapon is simply a talking point, that they cannot see any possibility of using such weapons without a conflict growing into an all-out nuclear war. Supporters of the Army's Pentomic division concept and the Air Force tactical aircraft nuclear close support approach, however, do not share this view.

On the necessity for developing bombs of 100 megatons or more, targeting officers comment that any strike against China would be directed at population more than industrial capability. Thus the "begaton" and "gigaton" bombs are anti-population weapons, producing more radiation and heat than explosive force.

In the case of Russia, however, where population and industry is more concentrated, the bombs would be smaller and directed at relatively pinpoint targets, rather than large areas.

Targeting of intercontinental ballistic missiles has assigned the comparatively lighter warhead solid propellant Minuteman to cities, while the Titan II storable liquid missile with a longer range and heavier payload will be aimed at hard sites further into enemy territory.

Sikorsky Designs High-Speed HSS-2

Sikorsky Aircraft has completed a preliminary design study of a high-performance helicopter based on the dynamic systems of the HSS-2 and calculated to be capable of carrying a two-ton payload at a speed of 209 mph.

Cost-sharing contract with U. S. Army's Transportation Research Command (TRECOM) specified a conventional single main rotor configuration, a ferry range of 1,840 mi., and a maximum speed of 200 mph., coupled with satisfactory flying and handling characteristics.

Sikorsky says the design objectives have been met or exceeded, and cites a 2,400-mi. ferry range and a 224-mph. top speed as examples. Two-ton payload can be carried for 150 mi. at a speed of 201 mph., and more than 7,000 lb. can be lifted by cutting that cruise speed to 173 mph., still substantially faster than contemporary helicopters.

New design features a low-drag fuselage and faired rotor hub and pylon. All landing gear is retractable to reduce drag. Fixed vertical and horizontal stabilizers fitted with rudder and elevator are used for control in the high-speed flight regime.

Powerplant will be the paired General Electric T58 shaft turbines as used in the Navy's HSS-2 and the commercial S-61. Fuselage capacity is planned around 20 troop-seats.

Company says that performance estimates were based on improved research methods in three areas: calculation of rotor performance in flight regimes beyond the application of existing theory; advanced work on blade vibratory stresses, enabling selection of the best compromise between stress and performance and eight years' research on flying characteristics including much time on flight simulators.

Skepticism Expressed On Bambi's Feasibility

Washington – There is considerable skepticism among scientists in the Defense Department over the feasibility of the Air Force Project Bambi concept (AW June 19, p. 33) of using missiles launched from satellites to intercept enemy ballistic missiles during launch, according to Assistant Secretary of Defense John H. Rubel, deputy director of defense research and engineering.

Despite this reservation, Defense Department believes it should fund such basic studies in ICBM defense techniques which show any promise of success, Rubel told the National Rocket Club last week.

Research Office Weapon Influence Grows

By Larry Booda

Washington—Tightened control over the selection of future weapon systems by Defense Secretary Robert S. McNamara is reflected in a continuing reorganization of the Office of Defense Research and Engineering.

Encroachment of this organization into the weapon selection field, as well as into operations and establishment of requirements, has not escaped criticism. Dr. Joseph V. Charyk, Air Force under secretary, recently told Congress he considers the organization "a little too large at the present time."

Increasingly powerful influence in the decision making process of McNamara and his deputy, Roswell L. Gilpatric, is wielded by Director of Defense Research and Engineering Dr. Harold Brown, who is number three in the Pentagon's civilian hierarchy.

McNamara, irked at what he considers narrow approaches to missions taken by all the services, has been highly critical of presentations which do not consider the entire defense picture. As a result, he is placing greater dependence on Dr. Brown's office in consolidating system research, development, test and evaluation.

Reactions of service officers have ranged from willingness to cooperate with the new civilian defense team to outraged statements that untrained civilians are meddling in traditionally military roles.

Dr. Charyk also told the House Military Appropriations Subcommittee, "I think there is always the real danger in accordance with Parkinson's law, that there may develop a whole series of echelons of review within the secretary's office. I think that the only sure cure to this is to put some limitations on the growth of an office responsible for R&D."

Dr. Brown, reorganizing his office, has reverted to having three deputies. (AW June 12, p. 36). Former Director Herbert F. York reduced them from three to one last March, and also ordered several assistant directors to report to his deputy instead of himself.

The first single deputy named in the March reorganization, Dr. John H. Rubel, was recently made an assistant secretary of defense for research and development, giving him equal footing with other assistant secretaries of defense and ranking him above the service assistant secretaries for research and development. He remains a deputy and is, in effect, Dr. Brown's alter ego.

Since that time, Dr. Marvin Stern, formerly assistant director for strategic weapons, has been made deputy director for weapon systems, and Dr. Eugene G. Fubini, formerly head of the directorate of research, now is deputy director for research. They report directly to Dr. Brown.

Thus, what were loosely tied assistant directorates for types of weapon systems will now be under Dr. Stern. There will be little change in Dr. Fubini's organization.

Alvin G. Waggoner, special assistant for space, is leaving to join the Airborne Instruments Laboratory of Cutler-Hammer, Inc. He will be succeeded by Dr. Lawrence L. Kavanau, manager of aerospace systems, space system operations, in the Aeronutronic Division of Ford Motor Co.

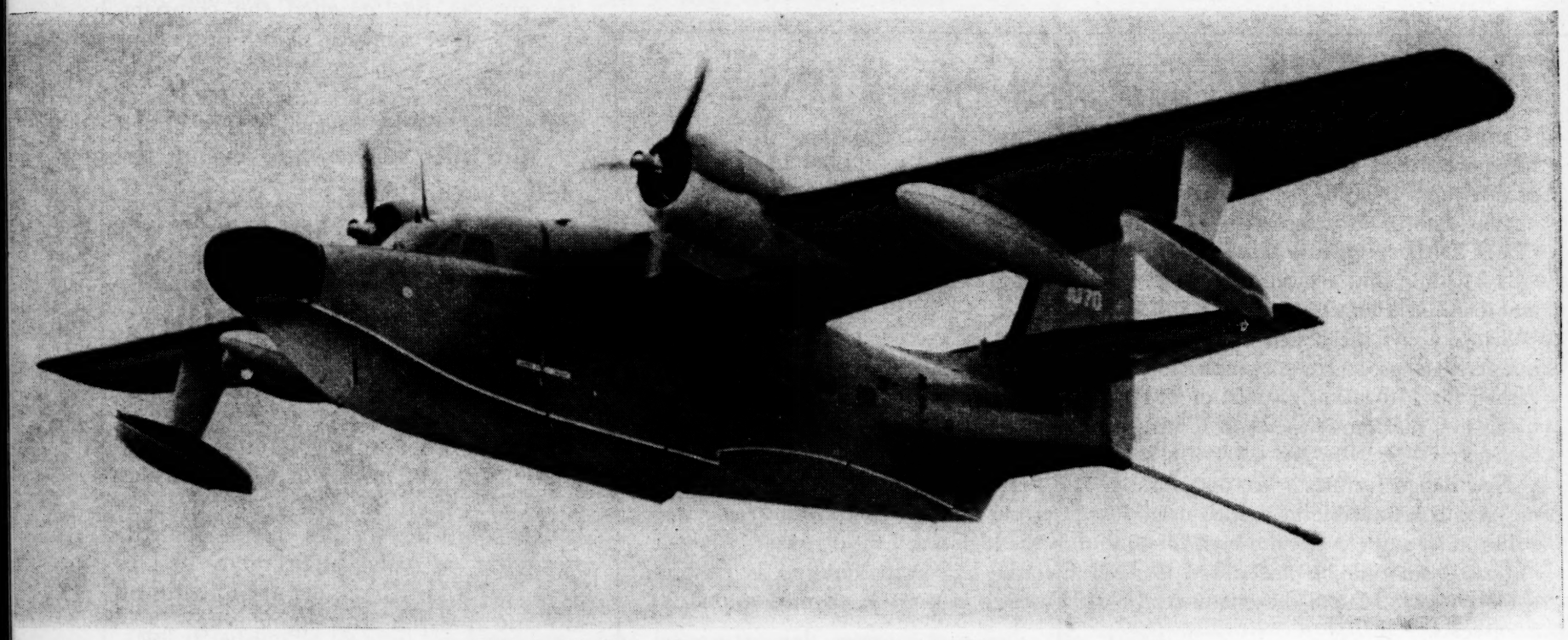
The assistant director for ranges and space ground support, which formerly was a deputy's position held by Air Force Lt. Gen. Donald N. Yates, will probably be moved to the directorate for administration. Gen. Yates, now retired, had been brought in to coordinate world-wide range and tracking efforts and to arbitrate difficulties between the Navy and the Air Force arising from the operation of the Pacific Missile Range.

The Advanced Research Projects Agency, under director Dr. Jack P. Ruina, and the Weapon Systems Evaluation Group, under Army Lt. Gen. William P. Ennis, Jr., will not be affected by immediate reorganization plans.

Dr. Stern emerges as the head of a group which will coordinate research, development, test and evaluation activities of all the services. He will be assigned a military assistant, of either general or admiral rank, whose principal duty would be liaison with the Joint Chiefs of Staff.

This group will greatly influence decisions made by Dr. Brown and the secretary and deputy secretary on which weapon systems are to be developed and become operationa..

Dr. Brown's office already has been given review authority over military



ASW Albatross for NATO Makes First Flight

Grumman SA-16 Albatross modified for NATO ASW missions makes its first flight. The twin-engine amphibian was modernized under the terms of a $1,648,000 military assistance program contract performed through USAF (AW Dec. 12, p. 89). It is equipped with modern search equipment, sonar buoy, air-to-surface radar, magnetic airborne detection gear and electronic countermeasures devices. Armament includes depth bombs, torpedoes and rockets.

space programs. Its recommendations are used as bases for decisions of the secretaries.

There have been indications that this authority has been extended to cover other weapon systems. First and biggest example of this was the review of the services' tactical fighter requirements. In this case, an attempt was made to integrate all service needs into a single package.

The centralization of review authority under the secretary of defense at first produced unfavorable reactions among service officers. They point out that the traditional military method of operation was for the services to be given roles and missions and then to generate requirements.

Thus, requirements would come from operating elements and be coordinated at staff level in the services. This would result in a requirement directive by the chief of staff of the Air Force or Army or the chief of naval operations. Then the research and development organizations would begin the cycles which would eventually result in operational weapon systems.

Now, in many instances, requirements are being generated in Dr. Brown's organization and to some extent in the office of Paul H. Nitze, the assistant secretary of defense for international security affairs, where ideas on weapon systems for limited war have been proposed.

There have been several instances, however, where requirements of the services have differed, making it necessary for the director of Defense Research and Engineering to step in and resolve the differences.

A hypothetical example, based on an actual case, concerned the ability of radars to track satellites of certain sizes. The Navy wanted the radars and other tracking devices to be built with the ability to track a satellite the size of a grapefruit. Air Force specified a requirement for satellites about 4 ft. in dia.

At this point, Dr. Brown's organization had to intervene and state the requirement.

Actual operations are involved in the ranges and ground support area. Budgeting is controlled in this office for the three national missile ranges and their supporting organizations, which include ships and aircraft. Range operations also have led to the establishment of requirements.

Service officers say they are confused by this state of affairs. They say they complete their work on studies for systems, only to have them restaffed and subjected to feasibility studies.

However, it is the encroachment of civilians into the area of operations that alarms them the most. Concentrated effort is being directed toward development of centralized command and control systems. One exaggerated description of the system depicts the President's office with a row of buttons for firing ballistic missiles.

Another area of criticism lies in duplication of effort by Dr. Brown's office. The staff of Joint Chiefs of Staff already has more than 900 officers and civilians, with panels that conduct reviews of every facet of defense. This staff, officers say, is capable of across-the-service studies which are thorough.

Defense civilian officials, however, point out that the JCS staff is not geared for rapid production of studies. On top of that, they say, when a study does reach the chiefs themselves, there often is disagreement.

Defense Proposes Incentive Plan To Cut CPFF Contract Volume

Washington – Defense Department has proposed a new kind of incentive plan tying profits to performance in an effort to reduce the volume of cost-plus-fixed-fee contracts.

Thomas D. Morris, assistant secretary of defense (installations and logistics), explained to a National Security Industrial Assn.-Defense Department symposium here that one plan now being considered would have a board of experts not directly involved in a contract determine how much profit or loss a contractor should get.

In this cost-plus-award-fee type of contract, an agreement would be made between Defense and the contractor on the target costs and definition of areas of risk. Then the range of fees would be established. This range could cover from minus 5% to a plus 15% of the estimated cost, with the exact fee to be determined after contract completion.

This final fee determination would be based on an evaluation of the over-all performance of the contractor by the board as well as the quality and reliability of the product judged against the defense operational requirement. This evaluation would include assessment of the contractor's efficiency, economy, ingenuity displayed in meeting contract requirements, changes in contractual requirements, assumption of technical, production and financial risks, breakthroughs achieved and the amount of government assistance required.

Proposal Criticized

This proposal met with criticism during a panel discussion on the grounds that any profit or loss would be delayed until very late in the life of a contract and that it would lead to overmanagement on the part of the Defense Department.

It also met a counter-proposal by P. E. Haggerty, president of Texas Instruments, who suggested "price" orientation rather than "cost." He pointed out that industry outside of defense-oriented companies is tied to price, adjusting it to the willingness of customers to pay. He said that prices vary according to the quality demands of the customers. Sometimes a product may cost two to three times as much as a result of adding a 5-10% quality factor.

Haggerty's proposal involves two approaches. One would be to let development contracts on a fixed price basis specifying parameters to be met, but adding a principal one, that of the price of the equipment in production quantities and rates. If the equipment met the specifications satisfactorily, the contract would also include a commitment to purchase the initial production lot at the fixed target price.

Where fixed price development contracts seem unsuitable, Haggerty proposes an approach where the development contract would be awarded on a cost-plus-fixed-fee basis with the usual overrun provision and with price on specified production quantities and rates a prime condition as in the first proposal. The fixed fee would be increased by an amount equal to the initial fee for each 5% decrease in the target price achieved.

Nerva Test Proposed As Saturn C-3 Stage

Washington—Marshall Space Flight Center has proposed testing the Nerva nuclear rocket engine as the second stage of the Saturn C-3 launch vehicle, which would give the newly-conceived vehicle its second mission in two weeks.

The C-3 is based on a cluster of two Rocketdyne 1.5-million-lb. thrust F-1 engines to power its booster stage. National Aeronautics and Space Administration previously said that because the Saturn C-2 would be marginal, the C-3 is proposed as launch vehicle for the Apollo B circumlunar mission (AW June 19, p. 26).

NASA earlier considered flight testing the Nerva engine as a second stage on the Saturn S-1 stage, which has a cluster of eight H-1 engines. (AW May 22, p. 30). The F-1 cluster is called S-1B.

Marshall last week established a nuclear vehicles projects office, headed by Air Force Col. W. Scott Fellows, to manage development of the reactor in-flight test (Rift) vehicle, which incorporates the Nerva engine.

Delta Vehicle's Role Expanded; More Tiros, Relay Flights Added

Washington – National Aeronautics and Space Administration has substantially expanded the launch vehicle role of the Douglas Delta and has increased its order to at least 23 vehicles, with the possibility that even more may be purchased.

Original plan was to consider Delta an interim vehicle and keep the order to 12 (AW July 4, 1960, p. 33). The Fiscal 1961 budget increased the number to 15 to accommodate three Relay payloads, and the Fiscal 1962 budget adds eight more vehicles for Tiros and Relay satellite missions.

Reasons for the added order are decisions to keep Tiros weather satellites operating in orbit until the second generation Nimbus is ready for launch, and to push the communications satellite program. The eight additional Deltas will provide five primary and backup vehicles for Tiros and three for Relay flights.

Using propulsion stages with long flight experience, Delta has performed well on three of its first four flights. First stage is a modified Douglas Thor, second stage a modified Aerojet Vanguard liquid rocket second stage, and third stage is a modified Vanguard Hercules-Allegany Ballistics Laboratory 254 third stage solid motor. Douglas-designed flight controller also has performed well in placing two satellites in near-circular orbits (AW Sept. 12, p. 61).

Only failure in the Delta program was the first launch, May 13, 1960, in an attempt to place an Echo passive communications satellite in a 1,000-mi. orbit. Second-stage attitude control system apparently failed, and the third stage did not receive an ignition signal.

Repeat of the Echo experiment Aug. 12 was successful, with initial orbital elements of 945-1,049 mi. The 100-ft. sphere is still in orbit, with solar pressure and drag affecting the altitude. Most recent orbit report puts the sphere at a 1,051-mi. apogee and 875-mi. perigee.

Third Delta launch Nov. 23 placed Tiros II in a 387-453-mi. orbit. Orbit now is 378-461 mi.

Fourth launch Mar. 25 was the Explorer X satellite, actually a magnetometer probe which went to a 112,500-mi. altitude.

Firm assignments have been made for these Delta vehicles:

- **No. 5, to place the 280-lb.** Tiros III satellite in a 400-mi. circular orbit. Flight is scheduled for next month.
- **No. 6, to orbit the 82-lb. S-3** energetic particles satellite at an apogee of 40,000 mi. and a perigee of 150 mi. Launch is scheduled in the fourth quarter of this year. Mission will be repeated with vehicle No. 12 during the second quarter of 1962.
- **No. 7, to place the 350-lb. S-16 solar** observatory in a 260-mi. circular orbit during the fourth quarter of this year. Vehicle No. 8 is a backup, and vehicle No. 11 is a mission repeat during the second quarter of 1962.
- **No. 9, to launch the 370-lb. S-6** atmospheric structures satellite into an orbit with a 650-mi. apogee and 125-mi. perigee. Launch is scheduled during the fourth quarter of this year.
- **No. 10, to launch Tiros IV,** with the same mission as Tiros III.
- **No. 13 and 14,** to launch 100-lb. Relay active communications satellites in 1,500-mi. circular orbits, during the last half of 1962. Vehicle No. 15 is a Relay backup.

British Designing STOL Freighters

London—Five British aircraft, one of U. S. derivation, are under design for a Royal Air Force requirement to eventually replace the Blackburn Beverley tactical transport, with emphasis on STOL capabilities.

British Aircraft Corp. is working on two aircraft to fit the requirement, which broadly specifies a turbine-powered, four-engine STOL airplane capable of payloads in excess of 50,000 lb. at gross weights of about 150,000 lb. The plane also would have rear-door or swing-nose loading.

One of the British Aircraft Corp. designs, the BAC 208, is on the boards at Bristol Aircraft. This airplane would be powered by four Bristol Siddeley BS.53 lift-fan engines now slated for the Hawker P. 1127 close-support fighter. The other is the BAC 222 boundary layer control version of the Lockheed C-130 which, for this requirement, would be powered by four Rolls-Royce Tyne turboprop engines. The Lockheed BLC-130 has been demonstrated to the RAF. Under terms of an agreement between Lockheed and British Aircraft Corp., the Tyne-powered version of the BLC-130 would be manufactured by the British firm under license if selected by the RAF for the STOL transport requirements.

At Armstrong Whitworth, development is centered on the AW 680 transport, an enlarged version of the AW 650 Argosy, which would use four BS.53s as the powerplants. A follow-on version, gaining less immediate emphasis, would use a combination of BS.53s with lightweight lift engines, probably Rolls-Royce RB.108s, on outboard nacelles. A design envisioning use of a cluster of RB.108s in combination with Tyne engines in inboard nacelles for VTOL purposes (AW Mar. 13, p. 277) has been dropped.

Short Brothers & Harland, Belfast, has proposed a boundary layer control version of its Belfast freighter now under construction for RAF. Bleed air would come from three RB.108 turbojet engines mounted in a hump on the upper center fuselage.

Although the RAF has issued its draft requirement for the Beverley replacement, the British Treasury has not yet made any funds available. All designs now under way are company-funded.

Discoverer XXV Retrieved From Orbit

Los Angeles—Discoverer XXV's 300-lb. instrumentation capsule was successfully retrieved last week from the Pacific Ocean after remaining in a polar orbit for more than two days.

The 2,100-lb. Agena B second stage made 33 passes on an orbit with an apogee of 250 mi. and a perigee of 140 mi.

Discoverer XXV, weighing in excess of 100,000 lb., was launched from Vandenberg AFB, Calif., at 4:03 p.m. PST June 16. Re-entry was commenced at 6:00 p.m. PST June 18.

Aerial retrieval failed when the capsule missed the drop zone, landing too far to the north. Air Force parachutists, trained in skin diving, jumped from an SC-54 which was guided to the area of the capsule by an aerial-retrieval Fairchild C-119. The parachutists hauled the capsule aboard a 20-man life raft dropped with them and remained at sea overnight until a destroyer arrived on the scene to take them aboard at 10:09 a.m. PST June 19.

Aboard the capsule were a number of radiation experiments including three Geiger tubes, ion and micrometeoroid density gages, plus rare and common metal samples—gold, bismuth, iron, titanium, cadmium, magnesium, nickel and yttrium. Also aboard the Agena B were devices to count and measure micrometeoroid impacts.

This was the 17th Discoverer vehicle to achieve polar orbit and the fifth instrumentation capsule to be recovered. No attempt was made to recover three of the orbiting Discoverers. Eight failed to achieve orbit.

Kennedy Asks Commercial Satellite Study

By Philip J. Klass

Washington—President Kennedy has asked the National Aeronautics and Space Council to study the complex issues involved in the commercial communications satellite controversy and to recommend a national policy on the space system.

President Kennedy asked the space council to give "the highest priority to the public interest" in reaching its decision. The need for White House intervention has become increasingly apparent as the controversy grew hotter and more complex in recent weeks (AW Apr. 17, p. 104).

Dr. Edward Welsh, Space Council executive secretary, met twice last week with representatives of the Federal Communications Commission, Justice and State departments, National Aeronautics and Space Administration, Office of Civil and Defense Mobilization and the President's Science Advisory Committee to discuss the problem.

The move followed strong expressions of concern over possible American Telephone & Telegraph Co. domination of a commercial satellite system from officials of the Justice Department and FCC in testimony before the House Anti-trust Subcommittee.

This mounting concern centers on the question of whether AT&T concepts would dominate the satellite system configuration and whether the company's manufacturing subsidiary, Western Electric, would get the lion's share of hardware production.

Sharp Comments

Sharply worded language used in a barrage of comments and rebuttals, filed last week with the FCC by AT&T, General Electric's Communication Satellites, Inc., Lockheed and others, reflects the high stakes involved.

At House Anti-trust Subcommittee hearings, the question of whether satellite system ownership should be limited to communication common carriers as recommended in FCC's First Report, or should be opened to aerospace and communications manufacturers, and how such a consortium should be operated, drew these views from key government officials:

• **Assistant Attorney General Lee Loevinger**, chief of the Anti-trust Division, said his department believes "it would be difficult to provide a free opportunity for all manufacturers to sell to the system if one manufacturer had an ownership participation and other manufacturers did not." The Justice Department objects even more strongly to AT&T's plan because it could "inhibit the incentive and opportunities for research and development," Loevinger said.

• **FCC Chairman Newton N. Minow** said: "We are not—I want to be as emphatic on that as I can—going to approve any plan that is going to give one company . . . any domination of the joint venture." Minow said the commission, "in my judgment, would not go along with any system [where the extent of ownership by each participant] was based on use, because we would regard this as giving the largest user a dominant position."

In a statement filed with FCC on June 19, four days after Minow's testimony, AT&T said that it believes that ownership sharing based on use "is the only practical principle for division of capital contributions between foreign agencies and the U. S. carriers as a group." However, as to division of ownership among the U. S. carriers, AT&T indicated that its views are flexible. Earlier, the company had proposed a similar ownership-according-to-use plan.

But Minow emphasized that serious problems would arise if system ownership were thrown wide open to other than communication carriers. "If every one of them [aerospace and communications manufacturers] wants in, we will have some very, very serious difficulties in figuring out a system . . . and we can not treat any company differently than another."

GE's Communication Satellites May 29 petition to FCC for reconsideration of its First Report proposed that 50% of initial ownership in the joint venture be allocated to the companies that filed in FCC's commercial communications satellite Docket 14024, indicating a desire to participate. This proposal would leave the remaining 50% for others who might subsequently desire to participate, including smaller business units and the general public. This suggested to some observers that under GE's plan, the only aerospace companies who would be eligible to join the carriers in 50% system ownership would be GE and Lockheed, the only aerospace companies to file a proposal in the FCC case.

However, a Communication Satellites official told AVIATION WEEK that this was not the company's intent, and that it believes the intial 50% ownership should be thrown open to all interested aerospace and communications manufacturers as well as the common carriers.

Lockheed, whose own proposal to establish an independent joint venture preceded GE's plan but which voluntarily stepped aside when the common carriers expressed a preference for owning the system themselves, told the FCC that "it is now up to the international carriers to show when and how this can be done. However, . . . if they can not do so in the immediate future, then other private interests who have indicated a willingness and readiness to undertake the establishment of a satellite system should be given the opportunity to do so."

Aerospace Firms Handicapped

Lockheed expressed concern that aerospace companies with competence in the satellite field would be handicapped in bidding for system research, development and hardware procurement unless adequate safeguards are provided or aerospace companies are admitted to system ownership. Lockheed points out that three of the common carriers or their parent companies—AT&T, International Telephone & Telegraph Co. and Radio Corp. of America—have large research and development laboratories and manufacturing facilities.

"If the international carriers, through their related hardware companies, conduct all of the research and development prior to the actual organization of the joint venture and then contribute such research and development to the joint venture, all outsiders would be effectively excluded from the R&D phase," Lockheed said.

Lockheed predicted the result would be that the carriers' control over design and engineering specifications would "discourage or preclude effective bidding by other hardware manufacturers for the ultimate equipment required."

If aerospace and communications manufacturers are not allowed to participate through ownership, Lockheed asks that FCC require the common carriers to throw open the research and development phase to competitive bidding.

This is important, Lockheed said, if the U. S. is to be first with a satellite communication system. The company said it would be inconsistent with this stated national objective "if any communications joint venture would ignore

Radical Rocket Studies

Washington—Approximately $1 million will be spent to study radical rocket engine concepts during Fiscal 1962 if President Kennedy's budget requests for the National Aeronautics and Space Administration are approved.

Studies will be continued in plug, spiked, expansion-deflection, horizontal flow and reverse flow nozzle designs under NASA plans.

the expertise of those who have participated in . . . the unique satellite systems of the Defense Department over the past 5 yr. and attempt at this late date to substitute their own partial knowledge and experience in this highly specialized field . . . this is the approach which at least one of the international carriers is taking."

This is a slightly veiled reference to AT&T which is attempting to design its experimental communication satellite largely with its own Bell Telephone Laboratories staff. The company has been reluctant to farm out major elements, preferring to do the over-all systems management itself.

In recent weeks, however, BTL engineers have visited a number of aerospace companies to discuss the possibility of giving them study/development contracts for work on small subsystems.

During one such visit, the host company asked the BTL representative about the prospects of future production for the subsystem under discussion, in the event it undertook the study for BTL. The reply was that Western Electric is preparing to produce satellites and that production probably would take place there, AVIATION WEEK was told. The aerospace company was told that BTL would insist upon a royalty-free right to any patents coming out of the aerospace company's study.

Another instance which creates apprehension in the aerospace industry involves the Nike Zeus anti-ICBM missile for which AT&T's Western Electric is prime contractor. Lear, Inc., developed the gyro stabilized platform used in the Zeus missile, and built a new factory at Grand Rapids to produce the platforms. Recently, it has been informed that Western Electric will establish itself as a second source to produce the platforms and that the present limited production will be divided between Lear and Western Electric.

An AT&T spokesman told AVIATION WEEK the company expects that "outside manufacturers will manufacture a substantial portion of the satellite system" which the company has proposed. He denies that Western Electric is establishing a group to produce satellites, or that it has plans to do so.

Commenting on Lockheed's latest views, AT&T told the FCC last week that the safeguards proposed by the commission in its First Report are adequate to assure equitable competition. "If Lockheed's position is that, despite the requirements of Paragraph 9 [First Report], those who plan and design the system will obtain a competitive advantage, then it follows that Lockheed's request to participate in such planning is for the purpose of obtaining a competitive advantage for Lockheed," AT&T says.

AT&T warns that "there is a practical limit to the number of people who can participate in the planning and design of the satellite system. If all the contractors who have sold aerospace goods and services to various government projects were to participate in the discussions between carriers, each would be promoting use of equipment designed by it, and decisions would be interminably delayed.

"If, as we believe, Paragraph 9 is adequate to protect the interests of the aerospace and hardware industries, then participation in the system planning and design by one or a few such companies or by all who are interested is unnecessary. The aerospace industry will, of course, be called upon to make important contributions to the success and efficiency of the satellite system . . . [their] knowledge and experience will be essential to establishment of a communication system using satellites," AT&T said.

Defense Hires Experts to End Non-Competitive Buying of Spares

Washington—Defense Department is hiring a group of 15 to 25 purchasing experts to eliminate unnecessary single-source, non-competitive procurement of aeronautical spare parts replacements.

Thomas D. Morris, assistant secretary of defense for installations and logistics, reported this to the House Armed Services Investigating Subcommittee last week in replying to a spot-check investigation by General Accounting Office which showed that 2,770 different aeronautical replacement spare parts procured from sole sources at a cost of over $106 million could have been bought competitively for "upward of $30 million" less.

Initial studies indicate that 25% to 30% of the $1.2-billion annual expenditure for aeronautical spare parts can be competitively procured, Morris reported to the subcommittee, headed by Rep. Edward Hebert (D.-La.). This would be approximately double the present level.

"If we can succeed in achieving this goal, we will capture savings of tens of millions of dollars," Morris observed.

He also emphasized to the subcommittee the complexity of the undertaking: Defense has 864,000 aeronautical parts in its supply system and each year purchases about 364,000 replacements.

"Very few are off-the-shelf items of a type commercially produced and consumed," he said. "Most have been specially engineered and designed to meet the exacting tolerances of military air weapon systems. Just to maintain and manage this vast array of special items, our manufacturers have furnished us over 13 million drawings; and each year new items or modifications of old items bring another 4-5 million drawings and specifications into our files. This alone results in one of the largest paperwork management jobs in all of government. . . ."

Admitting "very frankly" that until now Defense's files of drawings and specifications "have not been brought fully under control," Morris reported that a new system is being installed under which millions of drawings and specifications—the key to competitive procurement—are being microfilmed and filed for ready reference on IBM cards. "Once achieved, one file clerk can maintain a file of 250,000 of these film cards, up-to-date at all times and ready for easy reference within minutes," he commented. "High-speed reproducing machines have been invented which will make a full-size copy from this small card in about 20 sec."

Morris defended "open contract" procurement of aeronautical spares—the system now widely used under which orders are placed annually for an indefinite total with the price later negotiated—in a limited area because it requires "about one-tenth of the effort."

He reported to the subcommittee, however, that a new procurement regulation will shortly be issued under which "every item reordered must be individually evaluated to determine whether it can be bought competitively. This regulation will require that a justification be established in any case where the order is placed under an open contract with a single source. Appropriate reviews of these will be required at a higher level.

"In other words, we will not allow the open contract to be used as a blanket authorization established months in advance of individual procurements, but rather will authorize its use only as an advance agreement with suppliers which establishes contract terms for items which are individually found eligible for procurement from that supplier."

Morris stated that he is "not satisfied" that an "adequate job" of pricing is being done on aeronautical spares which must necessarily be procured from a single source. In some instances, he said, Defense will purchase direct from subcontractors—although there is nothing "intrinsically wrong" with purchase through a prime contractor if the prime performs essential functions of design and quality control.

RESCUE

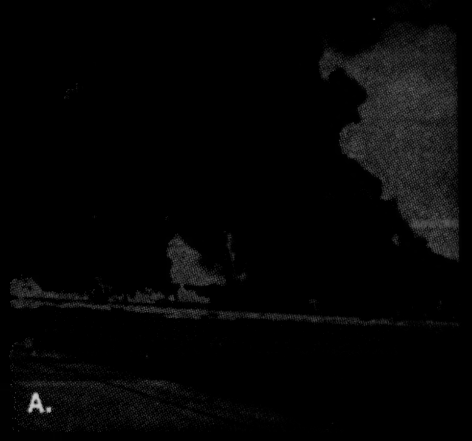
The Kaman HUSKIE was designed to be a rugged, reliable rescue helicopter. It was bred for the boondocks. The number, nature and difficulty of the rescues it has completed since entering operational service prove it was bred right. Rescues involving Kaman helicopters which hit the headlines recently follow below, with on the spot photos to the right.

A. LARSON AFB, WASH.— A Huskie hovering over the burning wreckage of a B-52D used its rotor downwash to keep flames away from the bomber's 128,000 pound fuel load until all 10 crewmen had been safely evacuated. (Air Force Photo)

B. CAPE HATTERAS, VA.— When the tanker Pine Ridge broke up off shore, a Kaman HUK operating from the Valley Forge rescued 9 crew members and returned them safely to its carrier base. (U.S. Coast Guard Photo)

C. RANDOLPH AFB, TEXAS USAF H-43 on standby alert reached the crash scene of a KC-97 tanker and worked with fire fighting crew to prevent flames from spreading to 4,000 gals. of spilled fuel, saving the aircraft. (San Antonio Field Photo)

THE KAMAN AIRCRAFT CORP., BLOOMFIELD, CONN.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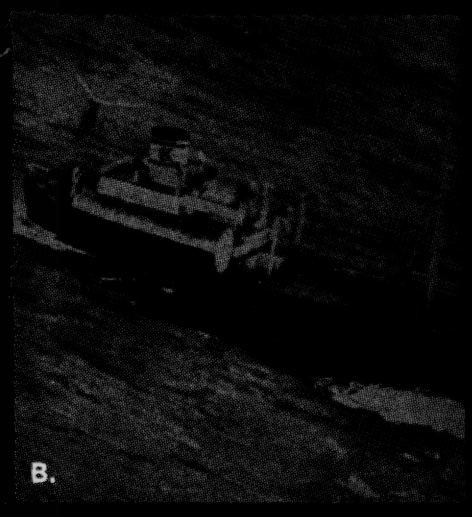
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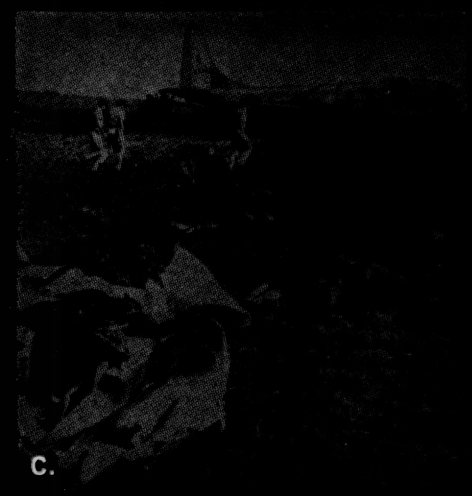
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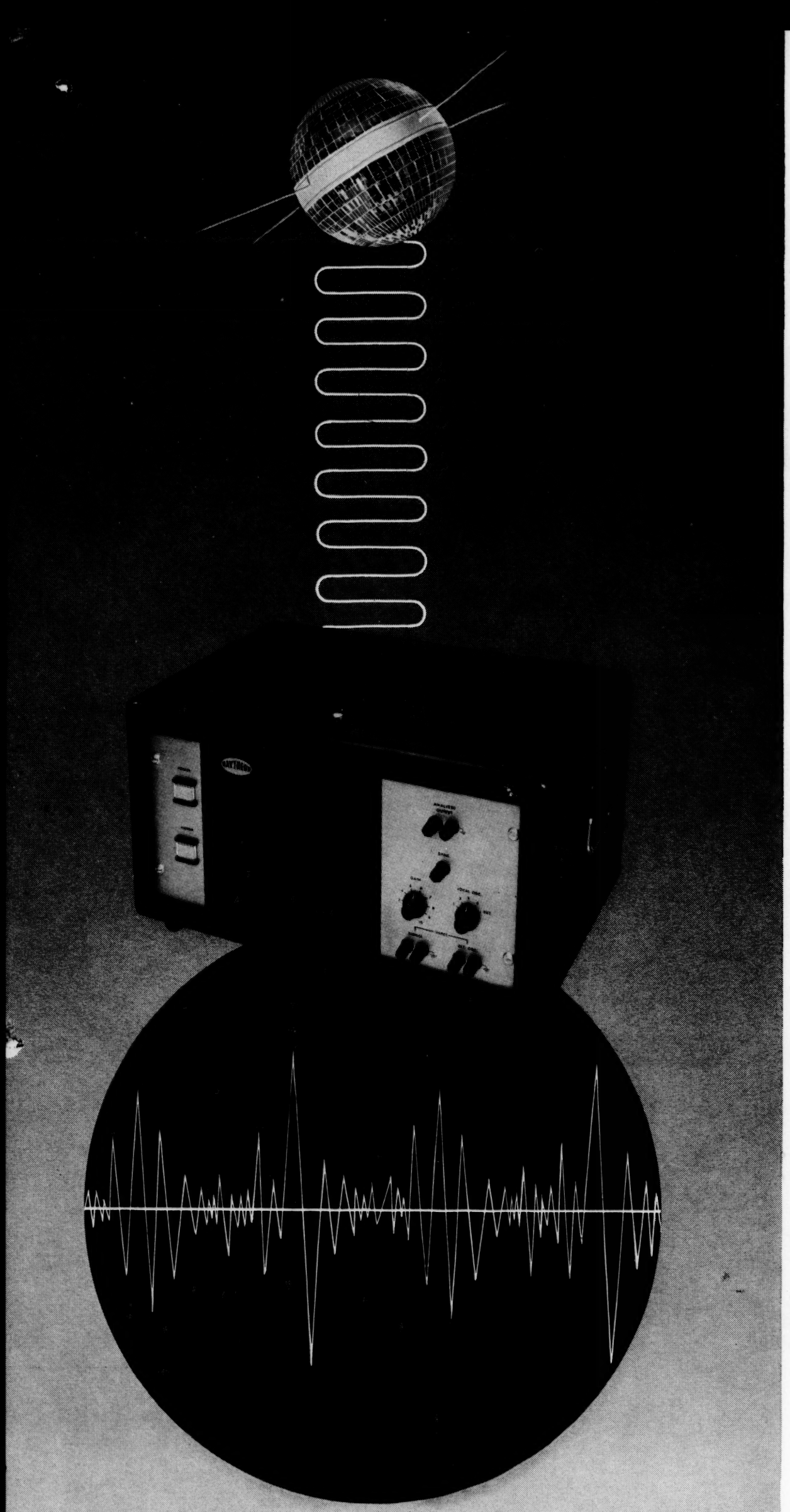
In national defense
KAMAN is a part of the rescue plan

This demonstration photo became a reality at PLATTSBURG, N.Y., when one of the crewmen who bailed out of a crippled B-52 was injured when landing in an isolated area of 100 foot trees. The crew of a Huskie saved his life by hovering over the spot and lowering a medic to give first aid until rescuers on foot reached the scene.



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NASA Attempts to Sell Program As Broader Than Lunar Goals

Washington – National Aeronautics and Space Administration officials are worried about the public image of NASA's multi-billion-dollar space program and are trying to portray it as much broader than an effort to reach the moon.

Hugh L. Dryden, NASA deputy administrator, told AVIATION WEEK that "we're obviously getting in trouble with the public" because of the focus on landing on the moon rather than on the accompanying scientific and technological returns of the space effort.

He said several NASA officials have been increasingly concerned with this public conception and have decided the best way to combat it is to emphasize that getting to the moon is just one goal, not the over-all objective of the program. Dr. Dryden said he hopes to be able to portray the moon shot as a research program similar to the one surrounding the X-15 supersonic airplane where speed advances are secondary to the flight knowledge gained.

NASA Administrator James E. Webb said he would not go so far as to say the agency was "in trouble with the public" but said "we run the risk of having the phase of putting a man on the moon represent the program when the 10-yr. program is a thorough exploration of space and applying the knowledge gained." He said the agency is trying "to find all possible ways to make this very clear to the public." Webb cited speeches and articles as part of his own effort toward this end, adding that he intends to continue them. He said he has accepted a number of speaking engagements from groups outside Washington.

This broadened sales effort is being pushed by several members of Congress, as was evident last week in the Senate Appropriations Committee's Independent Offices Subcommittee hearing on the NASA budget. Chairman Warren G. Magnuson (D.-Wash.) told Dr. Dryden that "there has got to be a lot of missionary work in regard to this proposal . . . so that the people will understand what we are trying to do. The space program has political implications. As it stands now, it looks as if we're just taking a jump at the moon. We're going to have to point out all aspects of this program."

Sen. Gordon Allott (R.-Colo.) expressed similar concern and said he had not been able to convince himself completely that the moon shot is worth the estimated $20-billion cost. He cited views of scientists along the same line.

"Might not manned satellites in space have more value to defense and the country generally than landing a man on the moon?," Sen. Allott asked Dr. Dryden during the hearings last week on NASA's budget. Dryden replied that developing manned satellites is one of the steps in getting to the moon and represents the type of technological achievements which will come from the effort.

He added that shooting for the moon rather than being an end in itself amounts to "setting of a goal which requires you to stretch your legs in science and technology."

Sen. Magnuson said the subcommittee probably will report the appropriations bill to the full committee next week.

Navy Chooses Bendix For Typhon Program

Washington–Navy selected the Bendix Corp. last week as prime contractor to develop the long-range Typhon surface-to-air missile planned for fleet use.

The Typhon system also will include a medium-range missile. A new type random pulse radar for the system is to permit 10 simultaneous firings at 10 targets and eliminates 13 different radars installed on a variety of ships.

The long-range missile will have a capability of flying to a 120,000-ft. altitude and a range of 200 mi. A high-power radar in the missile will enable it to penetrate, or "burn through" a heavy countermeasures barrage or jamming. It is expected to enter fleet service in 1966.

Preliminary design work on the missile has been done by the Applied Physics Laboratory of the Johns Hopkins University, which will have technical direction of its development. McDonnell Aircraft Corp. will build the airframe.

Soviets, British Fail To Track Venus Probe

Repeated attempts by Soviet and British scientists to re-establish radio contact with the Sputnik VIII Venus probe at the Jodrell Bank tracking facility have failed. The probe was launched Feb. 12, and communications were lost Feb. 27.

Soviet Prof. Alla Masewitch and Dr. Jouli Khodrev were at Jodrell Bank June 9-16 to assist in the tracking. USSR said the probe passed within 62,500 mi. of Venus May 19-20.

News Digest

Vice Adm. George W. Anderson was nominated as chief of naval operations with four-star rank last week to replace Adm. Arleigh A. Burke, who is to retire Aug. 1. Adm. Anderson, 54, currently is commander of the U.S. Sixth Fleet and of Naval Striking and Support Forces, South Europe.

General Dynamics Corp. is omitting its third-quarter dividend. Continued drain on earnings of the Convair 880 and 990 commercial jet programs was cited by directors last week as a major reason for passing the dividend, cut from 50 cents to 25 cents quarterly last year.

House approved President Kennedy's plan to streamline the Civil Aeronautics Board last week, and unless the Senate objects, the plan goes into effect July 2. Essentially, the plan authorizes the chairman to delegate Board functions to a Board division, CAB member, hearing examiner or Board employe.

Federal Aviation Agency plans to discuss the first draft of a regulation governing certification requirements for turbine-powered helicopters with its recently formed Helicopter Air Carrier Advisory Group on July 6. A preliminary meeting between the advisory group and FAA Bureau of Flight Standards officials was held last week.

Air Force has centralized control of the design of automated data processing systems under the Air Force Comptroller's Office. Col. George H. Krieger, named Assistant for Data Automation, will define objectives and policy for designing business data systems and command and control systems within the Air Force.

Air Force estimates at least a million micrometeoroid particles were trapped in its Aerobee-Hi payload in a flight early this month (AW June 12, p. 36). Concentration of particles is 100 times earlier estimates.

Air Force Systems Command has officially adopted Navy's terminology of PERT (Program Evaluation Review Technique) and abandoned its own name of PEP, as part of an effort to achieve tri-service standardization in terminology and techniques.

Japan Air Lines has ordered a sixth Douglas DC-8, a turbofan-powered version, for March, 1962 delivery. The carrier lost one DC-8 earlier this year in a non-fatal landing overrun at Tokyo, so the fleet now totals five. Cost will exceed $6 million including spares.

U.S.-Europe Overcapacity Grows Critical

Traffic falls below 1960 levels as capacity climbs; low fares, group discounts suggested as solutions.

By Glenn Garrison

New York—North Atlantic carriers, faced with a critical drop in the volume of passengers despite vastly increased seat capacities, are not optimistic about making up lost ground this year.

With capacity on the North Atlantic up 41% last month as the peak season got under way, the total of passengers carried fell 1% to 151,317. Eastbound load factor from the U.S. to Europe dropped to 53%. In the early weeks of June, the trend worsened.

For the week ending June 3, U.S.-to-Europe traffic was down 11% to 19,484 passengers. The eastbound load factor—normally extremely high for that period—was 53.3%. According to most estimates, the decline continued well into this month but may be leveling off in recent days. Airlines report an improvement, but in most cases only in relation to the slump.

One assist the carriers were expecting last week was traffic diverted from ocean liners tied up in a shipping strike.

A leading travel agent estimates that airline tourist traffic to Europe for most of June is off 20%. Many escorted tours have canceled out and others are leaving not fully booked.

Westbound traffic to the U.S. has looked a little better. For the week ending June 3, for example, it was up 6% with a load factor of 50.4%. For May, total westbound transatlantic traffic was up 2% with a 45% load factor. Reasons cited are increased travel by Europeans and returning U.S. military dependents.

Reasons for the critical slump are generally reported to be the same as discussed in an AVIATION WEEK survey earlier this year (May 1, p. 40). At that time, advance bookings were weak but the carriers hoped that the trend to later bookings would mean that the needed traffic still could materialize. But there were many uncertain factors, including effects of the business recession, international political unrest, and publicity concerning the U.S. gold drain and imbalance of payments.

Some airline officials believe that the transatlantic carriers are running out of market, and the only real answer is lower fares and new developmental plans such as excursion and group discount rates. At any rate, a vast increase in traffic was needed this year to meet the mushrooming capacity. With traffic actually falling below 1960 levels recently, the serious trouble is evident.

Estimates of traffic results for the year now range around a 5% increase, while capacity will show an increase on the order of 45%.

For the first five months of 1961, capacity was up 48% on the North Atlantic to 1,154,800 seats in both directions and traffic was up 11% to 566,920 passengers. April traffic was up 9% and April capacity up 54%. The severe pinch began in May, with load factors steadily tapering off that month.

The abundance of summer season capacity has caused another problem: high peaking of weekend business. Passengers not only book at the last minute, well aware that plenty of seats are available, but they are able to book on the preferred weekend flights, thus scooping out the midweek loads. Previously, with weekend summer space at a premium, the carriers could spread the business more readily throughout the week.

Another facet of the high-capacity jet is the automatic increase in available seats that results with the same flight frequencies after the switch from piston equipment. To maintain, say, a daily frequency with jets rather than cut back schedules, an airline must accept an almost doubled capacity whether it wants it or not.

Some officials feel that part of the problem is the fact that carriers are fighting for the existing market instead of going after new business. Advertising and promotion, in this view, should be geared not so much to the glamour aspects of a particular service but to the basic price and transportation.

In the present situation, some carriers are feeling the bite worse than others because of particular advantages and disadvantages in the competition.

For example, Pan American showed a 24% increase in eastbound traffic for the week ending June 15, and the airline expects to hold at least to the 10% increase recorded for all of May. Pan Am's capacity, far ahead of its competitors, results in more traffic, but of course at some cost in load factors. The airline's present peak season capacity totals 9,300 weekly eastbound seats, a 72% increase over last June's offering. Despite the large capacity offered last month, however, Pan Am's eastbound load factor was about 58%, good in relation to most other carriers.

The importance of ethnic considerations probably accounts at least in part for the relative success of such carriers as El Al Israel, with a 79% load factor for most of May, and Irish Airlines, with a 72% factor for the same period. However, the capacity of these airlines is small in relation to the bigger carriers.

Air-India, with a load factor of 33% for most of May, has two particular problems in the competition: lack of a daily frequency, which it considers essential and is presently not authorized to fly; and the fact that it is a newcomer to the transatlantic scene. Air-India for the present has to sell destinations in Europe rather than cities in its own country, since the

Eastbound North Atlantic Traffic—May 1-27, 1961

	Flights	Seats	Passengers	Load Factor
Air France	89	12,000	5,736	48%
Air-India	20	2,612	857	33
Alitalia	50	6,629	3,699	56
BOAC	139	16,357	9,649	58
Canadian Pacific	26	2,729	1,315	48
El Al	24	2,560	2,012	79
Iberia	12	948	223	24
Irish	17	2,003	1,441	72
KLM	101	10,385	5,845	56
Lufthansa	63	8,140	5,370	66
Pan Am	232	27,084	15,645	58
Qantas	8	736	431	59
Sabena	44	6,204	2,165	35
SAS	80	10,559	5,097	47
Swissair	47	6,048	2,840	47
Trans-Canada	57	7,236	4,677	65
TWA	122	15,736	8,241	52
Totals:	1,131	137,966	75,243	55

traffic to India has not yet developed to anything like its future potential. And the European market was highly competitive before Air-India entered the picture.

Scandinavian Airlines System, with a load factor for the period of 47%, expects to do better for the rest of the season because its traffic tends more strongly to peaks and valleys than that of its competitors. SAS's capacity is up 14% from New York and 20% from Los Angeles. It expects to carry about the same number or slightly more passengers this month than last June but with a load factor down about 10%.

Iberia Air Lines of Spain, with a load factor of 24%, emphasized the position a carrier faces without jets. Iberia plans to introduce jet service next month.

Alitalia's capacity increase for May was 192% on the North Atlantic to 7,570 eastbound seats. Passenger total increased 96%, but load factor fell from 81% to 54%. For the first 11 days in June, the airline's eastbound load factor was 62%. Alitalia, more than some other carriers, can stand the big boost in capacity in view of its relatively small share of the capacity to travel-popular Italy.

Trans World Airlnes reports June loads down as much as 20% from the same month of last year. Business has been picking up, but is still behind last June's.

Some carriers report traffic about the same as last June despite big capacity increases. Bookings for next month in some cases appear encouraging to some extent. but as one official put it, "the airlines will never make up for falling short this year."

Eastbound traffic last month was down 3% to 81,797 passengers, and the 53.1% load factor compares with a 79% load factor in May, 1960. Westbound, the total was up 2% to 69,520 passengers, with a load factor of 45% compared with 65% last May.

The April load factor eastbound was 53%, compared with 77% in April, 1960.

Scheduled airline charter traffic on the North Atlantic for April, the last figures available, totaled 10,123 passengers, up 23% from the previous like month.

Route Grants to Foreign Airlines Protested by Seven Congressmen

Washington – Seven congressmen joined forces on the House floor last week in vigorous protests against "excessive" route grants to foreign flag carriers, demanding that bilateral air transport agreements be reopened and re-evaluated.

In an attack led by Rep. John Jarman (D.-Okla.), the group accused the State Department of giving away profitable air routes into the U.S. to foreign flag carriers at the expense of U.S. international airlines. Rep. Jarman's charges were based on the current dispute over the grant of a Tahiti stop to Qantas Empire Airways on its U.S.-Australia route in direct competition with South Pacific Airlines (AW May 22, p. 46).

Rep. John F. Shelley (D.-Calif.) had this to say on bilaterals: "The State Department apparently feels that the operation of American airlines are protected by the capacity limitations written into aviation agreements . . . such thinking is just an exercise in delusion, for foreign carriers are not inhibited by the sacred words."

He also said that "we should take a long look and cautious look at future accords, and we should re-evaluate and reopen agreements such as the 1957 exchange of notes [amendments to the U.S.-Australia bilateral agreement), where extremely foolish trades were made and where there have been gross violations of agreed limitations."

Rep. Peter F. Mack (D.-Ill.) referrred to a half-billion-dollar deficit each year in the international balance of payments caused "by the deficit in international travel." He said that foreign lines are receiving "nearly half-a-billion more" than American lines.

Rep. Frank T. Bow (R.-Ohio) called for an immediate congressional investigation to determine why American interests are not being protected, and Rep. Arthur J. Younger (R.-Calif.) asked why the State Department continues to "give weak routes and weak consideration to our own flag carriers." Reps. William Maillard (R.-Calif.) and Dante B. Fascell (D.-Fla.) supported the protests.

Trunks Lose $16 Million

Washington—Trunk airlines lost almost $16 million in the first four months of 1961, according to Air Transport Assn.

The net loss was the largest for any comparable period since 1947, ATA said, when the trunkline loss totaled $21.3 million for the full year. In the first four months of 1960, the trunk carriers reported a net loss of $9.6 million.

Operating revenues for the 1961 four-month period were $624.2 million, a 2.7% increase, and operating expenses totaled $636.9 million, a 1.9% increase, according to ATA.

Russians Show More Interest in Caravelle

Toulouse—Soviet delegation visiting the Sud Aviation production facilities here on a post Paris Air Show tour have made inquiries into a possible order for Caravelle medium-range jet transports. Russians have publicly expressed interest in the Caravelle on at least two previous occasions but without results thus far.

A Sud official said last week that "in a very, very vague way," the Soviets have indicated they may now be prepared to discuss an actual order. There was no indication as to numbers or as to how the Caravelles would be used if ordered. Presumably, however, they would be delivered to Aeroflot, the Soviet state-owned airline, to supplement the carrier's fleet of Tu-104 medium-range jet transports.

Subsidy Will Double SAS' Working Capital

Stockholm—Parliaments of Sweden, Denmark and Norway are allocating funds that will more than double the working capital of Scandinavian Airlines System (AW Mar. 20, p. 34).

Total of $40.9 million is being provided by the three nations in response to a plea for aid by SAS. Sweden, the largest of the three and with the most SAS stock, is providing $17.5 million Norway and Denmark 11.7 million each. The three governments together own a total of 50% of the airline's stock.

SAS working capital prior to the allocations was approximately $31 million.

Cunard Wins Atlantic Route Battle

London—Cunard Eagle Airways has won its fight to fly the North Atlantic in competition with British Overseas Airways Corp. (AW May 29, p. 35).

Air Transport Licensing Board last week approved daily Boeing 707-420 service primarily from London to New York effective Aug. 1, with optional stops at Manchester, Prestwick, Philadelphia, Boston and Baltimore-Washington.

Cunard Eagle, an independent British airline, plans to start service in May, 1962. The license, the first granted by the British to an independent airline in opposition to a state-owned flag carrier, is valid for 15 years. British also are considering independent applications for European routes (see p. 43).

BOAC plans an immediate appeal on grounds that a material traffic diversion will result from the decision.

Halaby Urges Congress to Support Supersonic Transport Program

Washington—Federal Aviation Administrator Najeeb E. Halaby urged Congress last week to support development of a supersonic transport so the U. S. aircraft industry can capture a larger share of the world market.

He said the supersonic transport is "the next major airframe and powerplant combination, is about a $3 billion market and therefore a great prize. . . . We have to have a partnership between the government and the airlines to get this thing built at any time, much less sooner than the Russians."

The FAA administrator cited figures showing the decreasing percentage of the world airplane market going to U.S. manufacturers. He said the government has an obligation to do what it can to help the industry and called FAA's request for $12 million to start a supersonic transport feasibility study a vital "minimum step" toward this end.

Halaby told the Senate Appropriations Independent Offices Subcommittee that the feasibility study is a minor expenditure when compared with the costs of the space program. "Now if this nation instead of wanting to go to the moon wanted to go to New Delhi in a commercial supersonic transport, we could build a national prestige airplane a lot sooner than 1970-72, when a commercially profitable airplane could be developed . . . but it is not," Halaby said, "as I understand it, our national policy or desire to go at Mach 3 to Paris or New Delhi as soon as we go to the moon."

The airline industry wants FAA to conduct the study, Halaby said. "Although there is no immediacy in their [airlines] demand for a commercial supersonic transport due to the heavy debt load and their low profit margin," he told the subcommittee, "there is a recognition by the airline presidents, conservative as well as liberal minded, once that new airplane is coming, to develop it in a commercial as distinguished from a military manner; to develop it economically and emphasize safety and practicability." Halaby said North American Aviation estimates it would cost $500 million to develop a supersonic transport. The transport ultimately would sell for $15 million to $16 million and should have a range up to 3,500 naut. mi., he said.

Commenting on the possibility of modifying the North American B-70 eventually as a transport, Halaby said that it will be too noisy and burn too much fuel to make it practical for commercial use.

The FAA is requesting $12 million in Fiscal 1962 for the supersonic transport feasibility study and plans to spend an additional $37 million the following year. The House has passed a bill to appropriate only $10 million for the study in Fiscal 1962. Also, the House Appropriations Committee in its report recommending that amount said FAA should not spend over $20 million during the first two years of the study. Halaby told the Senate subcommittee the agency would rather not conduct the study at all than try to conduct it within this $20-million limit.

Halaby asked the Senate subcommittee to restore other cuts made by the House in the FAA budget, including $4.55 million for a wind tunnel to determine how best to fight aircraft engine fires. The House Appropriations Committee, in denying the tunnel request, said FAA should modify government wind tunnels already in existence. But Halaby said this would be more expensive than building a new one since none of those available comes close to fulfilling requirements. The FAA hopes to build the tunnel at its Atlantic City facility.

Halaby conceded there is duplication between civilian and military agencies in radar operations and in the gathering of weather information. He said a study on integrating military and civilian radar systems is just about completed.

Supersonic Transport Design Guides

Ft. Worth, Tex.—Basic research parameters for a supersonic transport will be firmed up by the National Aeronautics and Space Administration and the Federal Aviation Agency by the end of 1962.

Research and development programs currently under way by these agencies are geared to "writing the book" for the guidance of manufacturers and airlines in the next 12 to 18 months, high-level NASA and FAA officials indicated here last week at a supersonic transport symposium. The symposium was sponsored by the Institute of Navigation in cooperation with the U. S. Air Force.

The aircraft industry, airlines and government agencies are now discussing a program leading to a safe, economically feasible supersonic transport that would be available in the 1970 time period. The NASA and FAA officials indicated that two major signposts are discernible now:

- **Although it is too early to be definitive about the performance of the initial airplanes that will be certificated, government financial assistance to industry will favor development programs on designs with ultimate performance in the Mach 3 regime.**
- **Successful employment of the supersonic transport will require development of a special traffic control environment tailored to suit the performance revolution that these new airplanes will impose on domestic and international air transportation.**

Indications are, that for economic and operational reasons, the initial airplanes will have performance short of Mach 3, but it appeared clear that government agencies involved in the program would be wary of supporting any program for a supersonic airplane that did not have design stretch capability of attaining Mach 3 to Mach 3.5 without major modification. With the present state of the technical art, this indicates that materials research funds, for example, would be allocated on the basis of their capability of withstanding skin temperatures and loads imposed by this performance and would rule out the light alloys.

Supreme Court Denies Retiring Age Review

Washington—Mandatory retirement for airline pilots at 60 was upheld by the U. S. Supreme Court last week when it refused to review a lower court decision supporting the controversial Federal Aviation Agency regulation.

Denial of the petition for review filed by the Air Line Pilots Assn. removed the last legal threat to the regulation, which has been in effect since March, 1960.

FAA Administrator Najeeb E. Halaby, who earlier indicated that he might revise the regulation, announced his decision to continue the regulation last week in a letter to ALPA.

Halaby advised ALPA President Clarence N. Sayen that after a careful study of all factors and after talks at a recent meeting of the International Civil Aviation Organization, he considers the regulation a "fair and reasonable" answer to the question of retirement age. During the ICAO discussions, he said, most countries supported a retirement age of less than 60. Promising to offer help to pilots retiring at this age, Halaby advised ALPA to seek "fair and equitable retirements" from the airlines.

CAB Sets Rate Floors for MATS Airlift

Washington — Civil Aeronautics Board, firmly asserting its authority in a new area, has established rate floors for airlines seeking Logair and Quicktrans contracts awarded by Military Air Transport Service.

Exercising its power to pass on exemption applications, the Board ruled last week that the rates quoted MATS by six U. S. carriers were "uneconomically low and inadequate to cover operating costs and provide a reasonable opportunity to earn a fair profit."

AAXICO, Slick, Riddle, World, Alaska and Capitol are the Logair and Quicktrans carriers affected by the Board's action. In some cases, the bids they filed in the hot competition for Fiscal 1962 contracts (AW June 12, p. 37) were 20% lower than the appropriate CAB minimum.

For more than a year the Board has applied minimum rates to overseas airlift contracts awarded by MATS. By repealing Part 294 of its economic regulations, under which blanket exemptions have been granted to domestic contractors, CAB served notice that it would broaden the scope of this control, despite Defense Department objections.

Commenting on the Board's new power during hearings on MATS last week, the House Military Operations Subcommittee indicated it will not pass judgment on the domestic minimums until they have been in effect for some time. But Chairman Chet Holifield (D.-Calif.) raised the question of whether CAB's rate setting represented an "intrusion" on MATS authority.

Herbert Roback, subcommittee staff administrator, also told AVIATION WEEK that the congressmen are interested in the impact the newly announced minimums would have on the "upgrading and modernization" of the Civil Reserve Air Fleet.

Testifying before the subcommittee Joseph S. Imirie, assistant secretary of the Air Force-materiel, said that "the objectives of our program cannot be achieved if carriers quote rates less than cost which could result in destructive practices and loss of capability." He acknowledged that some of the carriers bidding for domestic contracts had quoted very low rates and expressed concern over the ability of these carriers to survive and expand.

As a result, Imirie said, Air Force "requested the chairman of CAB to review these rates to determine whether they are fair and reasonable, and to provide guidance . . . in the event the quoted rates were not satisfactory . . ."

Despite Air Force concern with the low bids, at least one carrier, World Airways, apparently was forced to accept a contract rate substantially lower than the one it first filed with MATS. Petitioning CAB for an exemption and "other relief," World stated:

"On June 2, World was notified by MATS that it could be awarded Item 1 [one of three Logair contract items bid for] at a rate of $1.301 per aircraft [Douglas DC-6A] mile, which rate was 31.8 cents less per mile than the rate which had been bid by World. World was given no opportunity whatsoever to negotiate a higher rate even though the rate offered is below the direct operating cost of World. On the contrary, World was told that it must either accept or reject the rate of $1.301 per mile by telegram immediately" or, the carrier believed, be excluded.

The rate floors set by CAB will take effect July 1 and last for 90 days while the Board launches a full-scale study of future rate minimums to be applied after Oct. 1. Temporary minimums set by CAB are $1.50 per aircraft mile for Douglas DC-4s in Quicktrans operations and 60 cents and $1.55 per aircraft mile for Curtiss C-46s and DC-6As, respectively, in Logair operation.

MATS told AVIATION WEEK that at least three possible courses of action were being considered late last week in the wake of CAB's stand that Logair and Quicktrans carriers had filed uneconomic bids. Specifically, MATS was weighing whether or not to:

- **Reduce the mileage** involved in each contract, thus bringing the awards up to CAB's rate floors without increasing the cost to the government.
- **Increase the dollar volume** of each disputed award to conform with the new CAB minimums.
- **Reopen the contract awards** involved and invite new bids from the industry.

Because successful carriers are scheduled to begin service July 1, the Defense Department is expected to do everything possible to avoid a second industry-wide bidding contest and the congressional complications that might result. For this reason, the reopening of the awards and the distribution of a second request for proposals is considered unlikely.

Continental Buys 720Bs

Washington—Continental Airlines will purchase a fleet of four Boeing 720B transports powered by Pratt & Whitney JT3D-1 turbofan engines at a total cost of $27.5 million. Delivery is scheduled for next spring.

Equipment program is being financed through a loan of $20.5 million, of which $15.5 million has been placed by Lehman Brothers with banks and long-term institutional lenders. Balance will be arranged for by Continental from other sources, including internal cash generation.

These organizations will participate in the loan: Aetna Life Insurance Co., Connecticut Mutual Life Insurance Co., New England Mutual Life Insurance Co., Ford Foundation; Connecticut General Life Insurance Co., American National Insurance Co., Jefferson Standard Life Insurance Co. and 25 banks headed by Chase Manhattan.

Basnight Will Head FAA Southern Region

Washington—Federal Aviation Agency's new regional organization centered in Atlanta, Ga., will be headed by Arvin O. Basnight, appointed assistant administrator last week by Administrator Najeeb E. Halaby.

Formerly deputy assistant administrator for management services, Basnight will take charge of all agency field programs in the new Southern Region, which encompasses Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, Mississippi, the Canal Zone, Puerto Rico, the Virgin Islands and Swan Island.

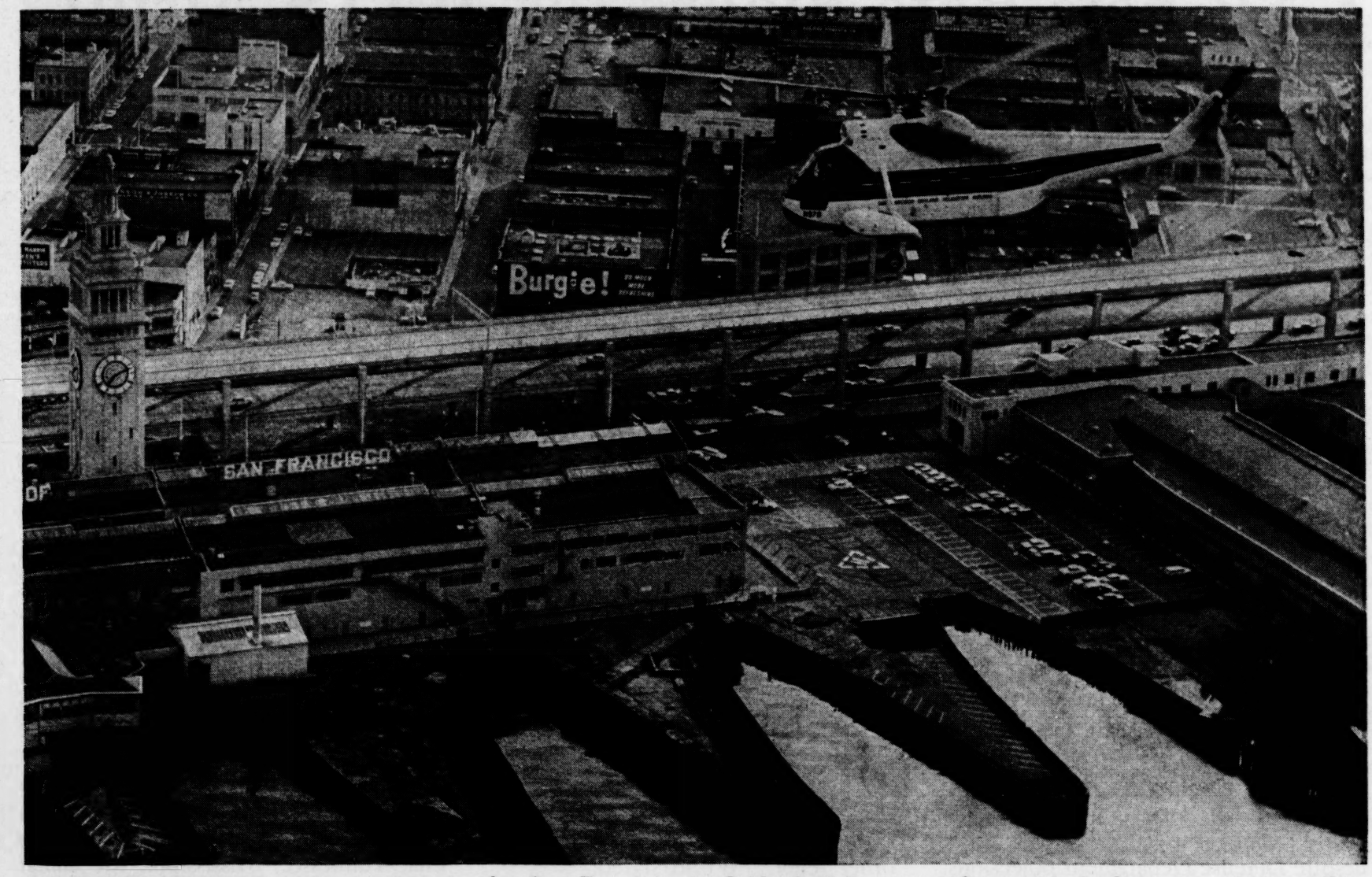
Scheduled to begin operation Jan. 1, the Southern Region was split off from FAA's Region II, which now covers only Arkansas, Louisiana, Oklahoma, Texas and New Mexico. When it is fully staffed in July, 1962, the new region will employ about 400 people.

Paul H. Boatman, now chief of the air traffic management division of Region II, will serve under Basnight as deputy assistant administrator.

As part of an over-all geographic reorganization, Halaby has renamed Region I the Eastern Region with headquarters in New York City; Region II the Southwest Region with headquarters in Ft. Worth; Region III the Central Region with headquarters in Kansas City, Mo., and Region IV the Western region with headquarters in Los Angeles. Alaska and Hawaii comprise the sixth and seventh FAA regions.

Pan Am Files SAS Charge

Pan American has asked Civil Aeronautics Board to take action against Scandinavian Airlines System, including possible withdrawal of the right of Sweden, Norway and Denmark to serve the U. S. through the SAS consortium arrangement. As it recently complained of KLM (AW June 19, p. 38), Pan Am charges SAS with offering service "in gross excess" of basic route demands and violating its foreign air carrier permit and bilaterals.



BAYFRONT HELIPORT (right, center) provides San Francisco & Oakland Helicopter Airlines with landing area within walking distance of city's financial district. One of the carrier's two Sikorsky S-62 helicopters is making approach over the Ferry Building. The heliport was originally part of a parking lot. Ticket office and waiting room are in the Ferry Building.

S-62 Service Is Begun in San Francisco

San Francisco & Oakland Helicopter Airlines, currently operating Sikorsky S-62s between four heliports in the San Francisco Bay area, is averaging 80-90 passengers per day and hopes to double this figure within 30 days.

The average load has increased from 40 per day when the airline began service June 1. Approximately 250 passengers per day, or slightly more than 91,000 per year, are needed for the line to break even financially, according to M. F. Bagan, president of the line.

Bulk of these passengers are being carried from downtown Oakland to San Francisco International Airport. The present Oakland International Airport will not accommodate jet liners.

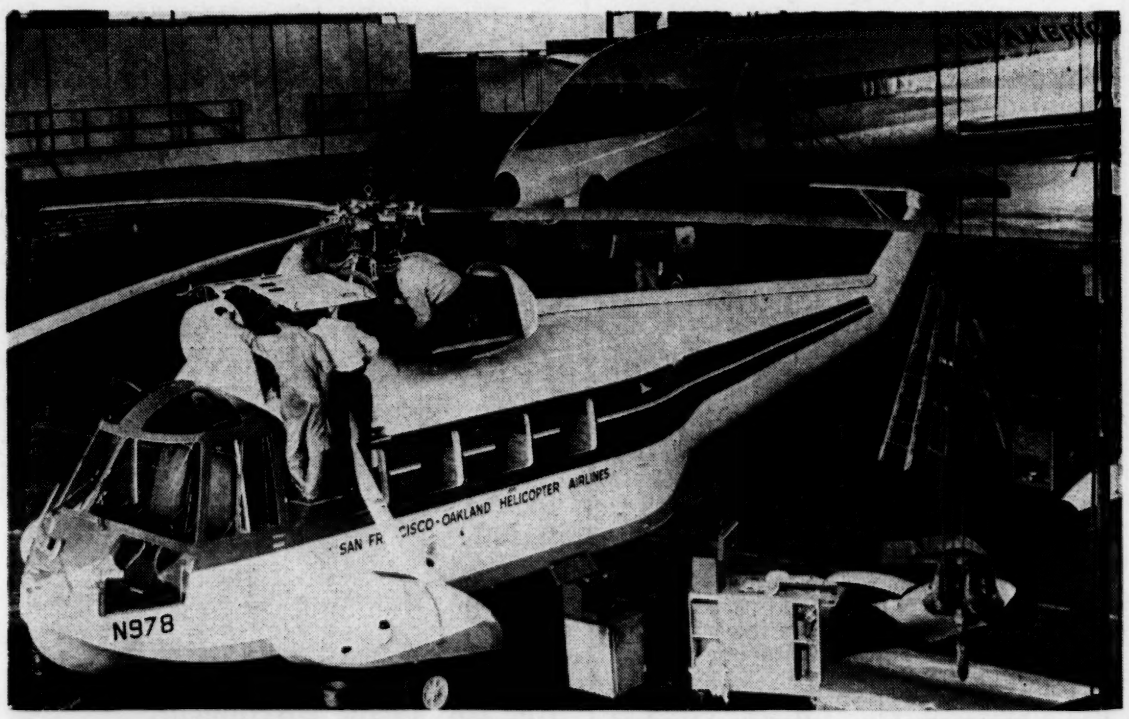
The line doubled scheduled flight frequencies two weeks after beginning operations, and now has approximately 65 point-to-point flights per day between 6:30 a.m. and 10:30 p.m. linking San Francisco and Oakland airports and downtown heliports in both cities.

Currently operating as an air taxi service under a blanket exemption granted by the Civil Aeronautics Board, the non-subsidized airline plans eventually, to expand service within a 100-mi. radius (AW Jan. 16, p. 43).

Negotiations now are under way with the city of Berkeley for construction of a downtown heliport there and the airline hopes to begin service within 30 days.

Other cities which may receive helicopter service are Sacramento, San Jose and Palo Alto.

The line operates two 10-passenger Sikorsky S-62s and has an option on a third. If traffic volume permits, a 28-passenger Sikorsky S-61L may be added.



MAINTENANCE WORK for San Francisco & Oakland Helicopter Airlines is performed in leased area of Pan American World Airways hangar at San Francisco International Airport. General offices of the line also are in the building. Pan Am Douglas DC-8 is at rear.

Bagan says fares are comparable to surface taxi fares in the area. The fare from downtown Oakland to downtown San Francisco and from downtown San Francisco to San Francisco International Airport is $6.50 one way. The fare from downtown Oakland to San Francisco International is $7.50.

The line rents 9,000 sq. ft. of hangar space from Pan American World Airways, Inc., at San Francisco International for general office, storage and maintenance use. It shares ticket and waiting-room facilities at the field with United Air Lines, but has separate facilities at Oakland International. The line has interline ticketing and baggage agreements with major carriers.

The line claims to be the first to operate an all-turbine-powered fleet. Approximately 99% of the flights are over water.

Bagan, organizer of the line, formerly was a trial attorney for the Civil Aeronautics Board Bureau of Air Operations, vice president of Los Angeles Airways and director of research for Central Airlines. Other officers include John J. Cunningham, vice president-assistant to the president; Bruce F. DeHaas, vice president-operations; Chester M. Schmidt, director of maintenance; and Roger E. Hall, director of traffic and sales. In addition to the five-man management team, the airline employs a staff of 39.

The downtown San Francisco heliport is located on the waterfront at the foot of Market St., adjacent to the Ferry Building. A temporary heliport in downtown Oakland, alongside the Oakland Auditorium, currently is served by the line. Later, service will be moved to a heliport atop a seven-level parking garage which is planned to be constructed soon.

British Independents Score BOAC, BEA on Foreign Pool Agreements

By Herbert J. Coleman

London—Pooling agreements made with foreign carriers were defended by British European Airways and British Overseas Airways Corp. against attacks by independent airlines as the Air Transport Licensing Board opened hearings on a complex set of United Kingdom-European routes.

The Board has allocated about six weeks to hear arguments on 72 routes, many of which have been the province of British European Airways until Parliament amended the Air Transport Licensing Act to allow independents to participate (AW May 22, p. 34).

The largest independent, British United Airways, seeks operating rights on 22 routes, Cunard Eagle on 18, Overseas Aviation on 11, Tradair on nine, Silver City and Starways three each, and East Anglian Flying Services, two.

Initially, BEA is seeking four new routes: London-Genoa, London-Malaga, London-Marseilles and London-Lisbon-Madeira. Because of the maze of routes—18 objectors are entered, making nearly 400 total objections, since applicants often are in opposition to each other—the board is hearing the airlines in alphabetical order.

Independent strategy appears to center on attacking BEA and British Overseas Airways Corp. pool agreements as evidence of monopoly. BOAC's pool agreement with Trans-Canada Air Lines, a 50-50 sharing on traffic, was first disclosed in bare detail at the North Atlantic route hearing (AW May 29, p. 35).

Copies of BEA pool agreements have been filed with the board but have been treated as confidential documents and are not aired in any detail during the public hearings.

Independent airlines attacks took form when Gerald Gardiner, counsel for British United Airways, cross-examined Anthony H. Milward, BEA chief executive, on the state-owned airline's relationship with Air France on the London-Paris high-density air traffic route.

Milward, asked by Gardiner "if the BEA-Air France pool did not result in a complete monopoly," replied in the affirmative, but later amended his answer to point out that six Fifth Freedom carriers also flew the route "but they do not carry a large proportion of the traffic."

In Milward's view, the London-Paris pool allowed the two national flag carriers to hold the line on fares on what he called a "short, expensive route" and to benefit the public by better service and equipment. Said Milward, "no one has suffered through the pool agreement."

Gardiner asked how many passengers are turned away by BEA and Air France, since load factors often are near 80%, but Milward said there could be no way of keeping such a record. He said BEA policy is to provide extra flights when traffic warrants and noted that the 80% load factors are only during the peak travel months of July, August and September.

In an apparent contradiction, Milward told Gardiner, in reply to queries on fares, that BEA policy would be to continue to strive for lower fares, primarily in introduction of night services and more tourist-configuration airplanes.

But he admitted that BEA "plans to go along" with International Air Transport Assn. member airlines who are seeking a 5% across-the-board fare hike in the winter months. He said BEA would support this in view of rising costs now plaguing all airlines.

In citing BEA's general position on route applications, Henry E. Marking, corporation secretary, reflected BOAC's position that allowing the independents parallel services will eat into BEA gains made over a long period of time with public funds. He referred to BEA's orders for British aircraft amounting to about $230 million and stressed that "high utilization is necessary" if BEA is to operate this fleet profitably.

(On the other hand, British United points out that it has ordered four Vickers VC-10 long-range jets and 10 BAC 111 medium-range jets at a total cost of about $50 million and Cunard Eagle has ordered two Boeing 707-420s.)

Four routes applied for by BEA are, Marking emphasized, "not designed to take traffic away from another British operator licensed for the same routes." Applications by the independents, he told the board, "seek to reap where others have sown," whereas BEA's applications result from long-planned development programs.

The British flag now serves 85 cities, 24 in Britain and 61 in Europe and the Middle East. Marking noted that despite present competition on the routes, BEA will carry 24% of all air traffic in Europe this year. Another factor, he continued, is that BEA has written off all development costs and has reserves of more than $10 million.

In stating British United's case, Gardiner objected to pooling agreements being filed as evidence for board eyes only, contending: "it is a well-recognized principle of English law that a board of this kind, exercising quasijudicial functions, is not entitled to receive evidence from one party without showing it to the other party."

BEA, he allowed, had produced a draft copy of a specimen pooling agreement, but not a copy of an actual working agreement. The state airline's position has been that disclosing pool details would jeopardize future negotiations with foreign carriers.

British United claims, in support of its applications, that today's air passenger is paying too much for his ticket and that a large, untapped pool is available for European travel. Gardiner said huge increase in North Atlantic travel followed fare reductions, but pointed out that there have been no reduced fares in Europe since tourist rates were introduced in 1953.

News of Local Service Airlines

Texaco offers this series of informative bulletins in recognition of the vital new dimensions being added to business activity by Local Service Airlines. Texaco Inc., Aviation Sales Department, 135 East 42nd St., New York 17, N. Y.

Texaco tells business and government leaders about the vital contribution of local airlines to American business activity through regular ads like this in Business Week.

This new campaign reports on ways to use local carriers to increase sales, reduce costs, solve problems, plan promotions, or relax.

Texaco is proud of its close association with the progressive airline industry.

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Reindeer take to the sky . . . on F-27. Reindeer can fly — **Northern Consolidated Airlines** prove it. Last November, the line transported 43 live reindeer on the first lap of their journey from Nunivak Island, Alaska, to Los Angeles. Some of Santa's helpers seemed a bit startled by this new experience, but all arrived live and kicking.

This goes to prove that local carriers can transport almost anything — safely and quickly. In the words of a local carrier sales representative, "If it's transportable, we'll find a way to take it."

Foreign tourists may favor smaller U.S. communities. Backed by vigorous promotion by the Federal Government and growing prosperity abroad, foreign tourism to the U.S. could as much as quadruple in the next decade.

Smaller communities offer many unique attractions to the foreign visitor . . . local color, historical points of interest, plus generally lower prices for accommodations. Judicious planning, in conjunction with local airline service, could enable these communities to capture a big share of the foreign tourist trade.

For example, a vacation trip for the foreign visitor might include historical homes, cities, and battlefields of the Middle Atlantic states — accessible through **Piedmont Airlines.** For a glimpse of America at its flamboyant best, he might visit such places as Las Vegas, Reno and Palm Springs on all-jetprop **Bonanza Airlines** flights.

Many local service airlines already offer "package" vacation tours to points of interest in their territories.

Bootstrap operation rebuilds economy of twin Illinois cities. When civic leaders of Merion-Herrin, Illinois, launched an all-out campaign back in 1943 to attract new industry, they gave air transportation top priority. A new multi-million dollar airport made the area readily accessible via **Ozark Airlines.**

Since then, no less than 50 new industries have moved into the area. Nearly 5,000 new jobs have been created. Air service has made an important contribution to this spectacular growth and has more than kept pace with the area's booming economy. Every month, **Ozark** flies an average of 600 passengers and 25,588 pounds of cargo in and out of Merion-Herrin.

Commuter-type, no-reservation service speeds businessmen in a hurry. Fast, frequent, commuter-type flights offered by many local carriers are made-to-order for businessmen who want to get around. Because of these flights, it is now possible to visit as many as four cities — hundreds of miles apart — in a single day.

Allegheny Airlines offers an exceptionally convenient commuter service. Reservations and baggage check-ins are unnecessary between such key cities as Pittsburgh, Philadelphia, Providence and Boston. Even ticketing is done in flight. Best of all, fare discounts average 35%.

Frontier Airlines schedules twice-daily commuter-type flights to most major cities in the Denver area. And **North Central Airlines** flights connect Chicago many times daily with such cities as Milwaukee, Detroit, Duluth and Minneapolis.

U.S. Delays Italy's Los Angeles Entry

By Glenn Garrison

New York—United States is delaying Italy's authority to serve Los Angeles in an attempt to force the Italians to support the U. S. interpretation of what constitutes Fifth Freedom traffic.

This interpretation is a central issue in the current hot bilateral battle (AW June 19, p. 38), and Italy appears to be in the line of fire from both U. S. and European sides.

Under a U.S.-Italian agreement of last summer which gave Los Angeles and Chicago rights to Italy, AVIATION WEEK has learned, both countries agreed to provide traffic statistics including primary and secondary Fifth Freedom figures as defined by the United States. The amount of capacity justified under these freedoms is at the core of the disputes between the U. S. and several European countries.

The Italians have provided the required statistics. But the U.S. now further requires the Italians to spell out formally that such information is called for under the original Bermuda-type agreement of 1948. In other words, the U.S. wants the Italians to go on record with a bilateral interpretation that other European carriers are strongly resisting.

The Italians feel this would put them squarely in the middle of the bilateral battle. Other countries, notably the Scandinavian countries, refuse to provide such statistics, which are considered necessary to measure Fifth Freedom traffic and what the U.S. calls "Sixth Freedom" traffic—traffic going beyond the second country under a bilateral agreement.

The U.S., according to the Italian view, seeks to use Italy as a wedge against other countries in the dispute. Italy is thus concerned about its relations and agreements with the other countries.

The U.S. State Department has no comment at this time on the Italian view.

The new Italy-U.S. agreement was supposed to have been followed up last December by an exchange of diplomatic notes making the amendments final. But while the U.S. indicated approval of Chicago, no further word developed on Los Angeles. Italy was to have been able to serve a Los Angeles-Montreal-Rome route not later than last May 10, or earlier if certain U.S.-Canada negotiations were completed.

According to Alitalia, it was ready and anxious to start Los Angeles service on schedule, and had made preliminary arrangements at the West Coast city in preparation for the service.

But when a U.S. team came unannounced to Rome late last year to work out the technical details of the exchange of figures, it developed that the U.S. required the interpretation to be confirmed also. And there the matter stalled. Italy has since provided the statistics, but not the confirmation of interpretation; and no authority for Los Angeles has been forthcoming.

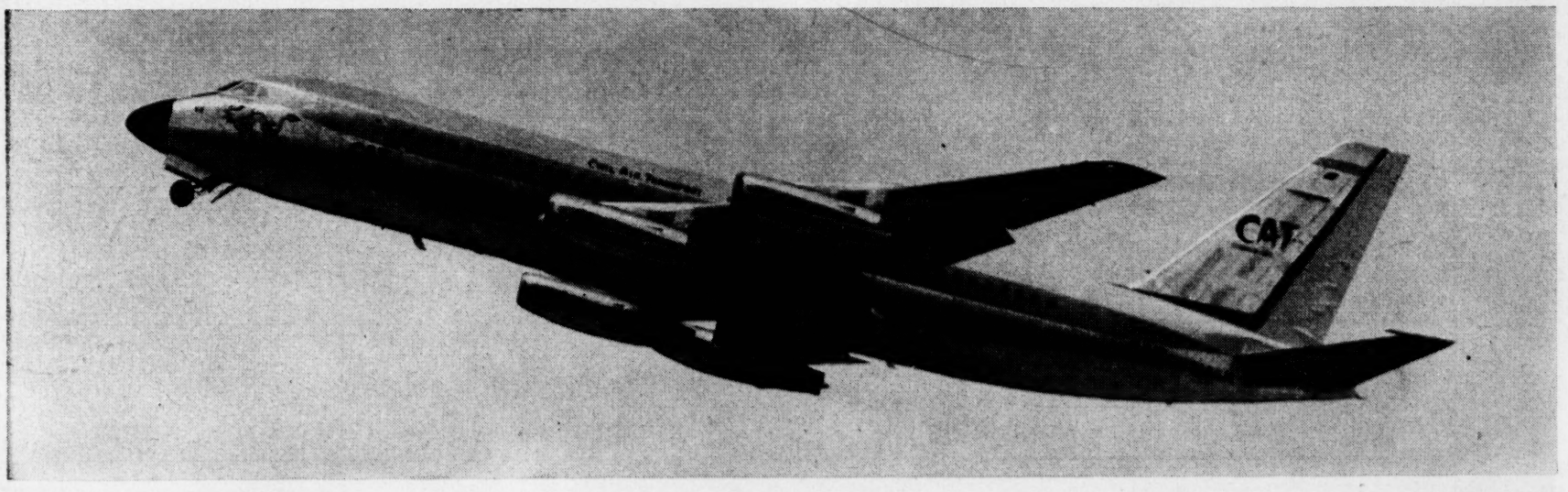
Meanwhile, Alitalia has not started serving Chicago, contending that such service is not feasible at this time.

The amended agreement of last summer calls for exchange of statistics covering origin and destination traffic carried in and out of each country. Each country will report traffic on board its international flight segments between a point in the other country and the nearest point served outside the other country. Origin and destination information will be broken down between Third and Fourth Freedom traffic, on one hand, and Fifth Freedom traffic on the other hand. Fifth Freedom traffic in turn will be divided into primary and secondary Fifth Freedom, defined as follows: primary Fifth Freedom is traffic which is Fifth Freedom to the nationality of the reporting airline, and Third and Fourth Freedom to the other country; secondary Fifth Freedom is traffic which is Fifth Freedom to the airlines of both countries.

Statistics on freight also will be exchanged on an origin and destination basis. Another provision is for reporting of volume of passengers and freight transit traffic carried over but not enplaned or deplaned in Italian territory.

In the Italian view, provision of such statistics is a facet of the new agreement and does not imply that the original bilateral should be interpreted as requiring such information. How the figures would be used to negotiate any future differences regarding capacity or other matters is something to be discussed at that future time, according to the Italians.

Last summer's U.S.-Italy agreement also covered procedures for handling substantial changes in capacity. U.S. laws do not require foreign flag carriers to file schedules, whereas Italian regulations do so require. Consequently, the U.S. agreed to file such notice of a major schedule or capacity increase 30 days before its effective date. If the changes involved problems from the Italian point of view, an attempt to work out differences would be made during this period. If the attempt failed, Italy could then request a formal consultation under the agreement's terms.



China's CAT Receives First Convair 880-M

First Convair 880-M was recently delivered to Nationalist China's flag carrier, Civil Air Transport, and designated by the airline as the Mandarin Jet. Aircraft seats 40 passengers in first-class section and 54 in the tourist cabin. Powerplants are General Electric CJ-805-3B engines, rated at 11,650 lb. thrust. Fuel capacity of the 880-M is 12,534 gal., 1,850 gal. more than the basic 880. Range is 3,750 mi.

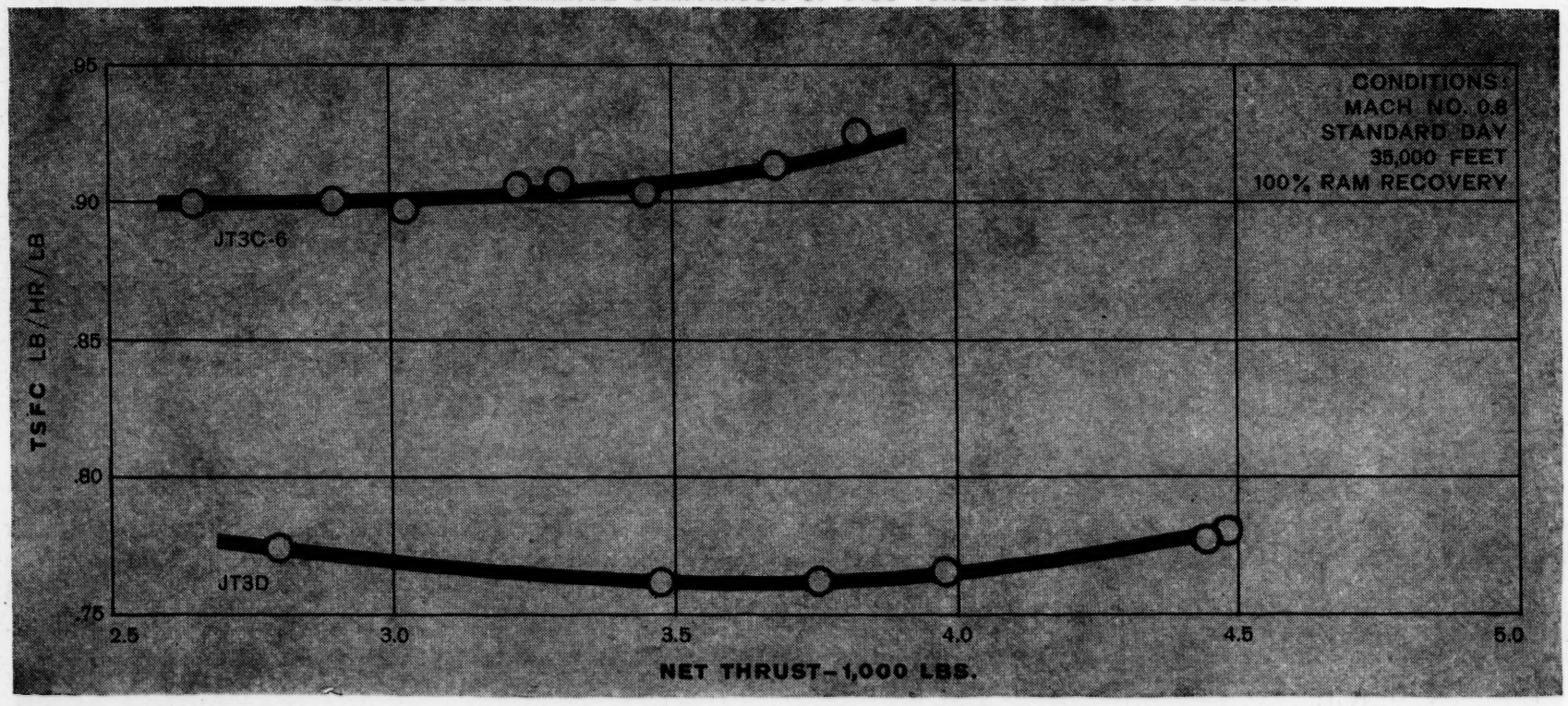
JT3D

cuts TSFC 15%—cuts fuel costs 20%

Compared with the conventional turbojet, the Pratt & Whitney Aircraft JT3D-3 turbofan engine has demonstrated a saving of over 15 per cent in specific fuel consumption at comparable cruise thrust. (See chart below.) The effect on operating expense is obvious—less fuel, lower costs. Furthermore, the turbofan's fuel economy is paired with a 22 to 26 per cent lower specific weight than conventional turbojet engines operating today. As a result, the Pratt & Whitney Aircraft JT3D-3 makes possible increased payload, and more than 20 per cent greater range.

PRATT & WHITNEY AIRCRAFT Division of UNITED AIRCRAFT CORPORATION, East Hartford, Connecticut

ALTITUDE PERFORMANCE COMPARISON OF JT3C TURBOJET AND JT3D TURBOFAN



Airlines List Officers' Salaries With CAB

Following is a list of airline officers' salaries, bonuses and indirect compensation, expenses, and stock holdings for the year ending Dec. 31, 1960 as filed with the Civil Aeronautics Board:

Pan American World Airways, Inc.—J. T. Trippe, president and director, $100,000 salary, no stock, 31,539 shares of common stock in the name of others, $5,441 expenses, $2,200 bonus and indirect compensation; **R. Lewis,** executive vice president and director, $40,000 salary, 5,825 shares of common stock, $7,336 expenses, $31,600 bonus and indirect compensation; **W. L. Morrison,** executive vice president-Latin American Division and director, $40,000 salary, 17,462 shares of common stock, 100 shares of common stock in the name of others, $11,088 expenses, $27,800 bonus and indirect compensation; **H. E. Gray,** executive vice president-Overseas Division and director, $40,000 salary, 10,927 shares of common stock, $3,109 expenses, $31,200 bonus and indirect compensation, $37,800 debt securities; **R. B. Murray, Jr.,** executive vice president $35,000 salary, 375 shares of common stock, $15,818 expenses, $15,000 bonus and indirect compensation; **J. C. Leslie,** vice president and director, $38,000 salary, no stock, 6,375 shares of common stock in the name of others, $2,478 expenses, $26,100 bonus and indirect compensation; **H. A. Schneider,** vice president and general counsel and director, $36,000 salary, 250 shares of common stock, $4,881 expenses, $3,300 bonus and indirect compensation; **S. F. Pryor,** vice president and director, $33,000 salary, 14,500 shares of common stock, $28,019 expenses, $16,950 bonus and indirect compensation; **F. Gledhill,** vice president and director, $38,000 salary, 5,202 shares of common stock, $4,439 expenses, $27,200 bonus and indirect compensation, $10,000 debt securities; **W. G. Lipscomb,** vice president-traffic and sales, and director, $38,000 salary, 13,408 shares of common stock, $7,344 expenses, $28,600 bonus and indirect compensation; **J. B. Gates,** vice president-development, $33,000 salary, 3,000 shares of common stock, $3,560 expenses, $14;000 bonus and indirect compensation; **A. P. Adams,** vice president, $32,000 salary, 2,500 shares of common stock, $6,860 expenses, $15,000 bonus and indirect compensation, $100 debt security; **E. Balluder,** vice president, $30,000 salary, 14,625 shares of common stock, 5,660 shares of common stock in the name of others, $6,213 expenses, $10,000 bonus and indirect compensation; **J. C. Pirie,** vice president and associate general counsel, $30,500 salary, 2,880 shares of common stock, 2,235 expenses, $10,000 bonus and indirect compensation; **R. B. Adams,** vice president, $30,000 salary, 3,040 shares of common stock, $8,403 expenses, $12,000 bonus and indirect compensation, $21,700 debt securities; **A. J. Kelly,** vice president, $22,488 salary, 1,408 shares of common stock, $2,633 expenses, $5,000 bonus and indirect compensation; **H. W. Toomey,** vice president, $20,000 salary, no stock, $7,634 expenses, no bonus or indirect compensation; **N. P. Blake,** vice president, $21,000 salary, 1,523 shares of common stock, $4,198 expenses, $5,000 bonus and indirect compensation; **H. R. Berke,** vice president-services of supply, $28,000 salary, 2,000 shares of common stock, $1,636 expenses, $14,000 bonus and indirect compensation; **E. M. Goulard,** vice president-industrial relations, $24,000 salary, 750 shares of common stock, $5,666 expenses, $8,000 bonus and indirect compensation; **R. S. Mitchell,** vice president-Guided Missiles Range Division, $29,000 salary, 2,547 shares of common stock, $6,969 expenses, $12,000 bonus and indirect compensation; **R. G. Ferguson,** treasurer, $30,000 salary, 2,940 shares of common stock, $5,321 expenses, $15,000 bonus and indirect compensation; **J. S. Woodbridge,** comptroller, $30,000 salary, 400 shares of common stock, $2,359 expenses, $15,000 bonus and indirect compensation; **J. Macy, Jr.,** secretary (from Aug. 1, 1960), $14,500 salary, no stock, $274 expenses, $2,000 bonus and indirect compensation; **H. P. Morris,** secretary and general attorney (until July 31, 1960), $8,750 salary, 3,157 shares of common stock, 316 shares of common stock in the name of others, $309 expenses, $4,500 bonus and indirect compensation; **S. B. Kauffman,** assistant vice president-engineering, $23,000 salary, 1,000 shares of common stock, $1,853 expenses, $9,000 bonus and indirect compensation; **W. W. Lynch,** assistant vice president-communications, $34,326 salary, 2,387 shares of common stock, $5,444 expenses, $6,000 bonus and indirect compensation, $15,300 debt securities; **J. C. Cone,** assistant vice president, $18,000 salary, 6,039 shares of common stock, $18,185 expenses, $7,000 bonus and indirect compensation; **W. J. McEvoy,** assistant vice president, $15,000 salary, 3,783 shares of common stock, $7,780 expenses, $3,250 bonus and indirect compensation; **R. E. Smith,** assistant vice president, $23,000 salary, 546 shares of common stock, $12,415 expenses, $4,000 bonus and indirect compensation, $400 debt securities; **H. M. Blackwell,** assistant vice president-services of supply, $17,500 salary, 150 shares of common stock, $1,004 expenses, $3,000 bonus and indirect compensation; **R. S. Hogueland,** assistant vice president-industrial relations, $21,000 salary, 750 shares of common stock, $5,582 expenses, $4,000 bonus and indirect compensation; **O. J. Studeman,** assistant vice president-Guided Missiles Range Division (from Apr. 5, 1960), $20,822 salary, 1,125 shares of common stock, $507 expenses, $3,500 bonus and indirect compensation; **C. W. Moore,** assistant vice president-traffic and sales administration (from June 7, 1960), $8,075 salary, 30 shares of common stock, $1,441 expenses, $1,500 bonus and indirect compensation; **R. P. Monson,** assistant treasurer, $20,000 salary, 1,434 shares of common stock, $3,944 expenses, $9,000 bonus and indirect compensation; **E. Drescher,** assistant comptroller, (from Sept. 16, 1960), $7,292 salary, 1,595 shares of common stock, $3,009 expenses, $6,000 bonus and indirect compensation; **J. E. McGuire,** assistant comptroller, $17,000 salary, 192 shares of common stock, $3,387 expenses, $4,000 bonus and indirect compensation; **L. E. Wickeri,** assistant comptroller (from Jan. 1, 1960 until June 28, 1960), $12,222 salary, no stock, $333 expenses, no bonus or indirect compensation; **E. G. Rothrock,** assistant secretary, $13,500 salary, 17 shares of common stock, 48 shares of common stock in the name of others, $2,822 expenses, $2,000 bonus and indirect compensation; **J. J. Cantwell,** assistant secretary, $10,300 salary, 94 shares of common stock, $452 expenses, $750 bonus and indirect compensation; **N. Chandler,** director, no salary, 1,000 shares of common stock, $473 expenses, $200 bonus and indirect compensation; **R. V. Fleming,** director, no salary, 200 shares of common stock, $267 expenses, $1,300 bonus and indirect compensation; **M. Griswold,** director, no salary, 400 shares of common stock, $372 expenses, $1,700 bonus and indirect compensation, $2,900 debt securities; **A. M. Gruenther,** director (from Apr. 5, 1960), no salary, 100 shares of common stock, $129 expenses, $600 bonus and indirect compensation; **R. L. Hamill,** director, no salary, 6,000 shares of common stock, no expenses, $600 bonus and indirect compensation, $150,000 debt securities; **R. W. Howard,** director, no salary, 300 shares of common stock, no expenses, $1,300 bonus and indirect compensation, $2,200 debt securities; **D. S. Ingalls,** director, no salary, 4,244 shares of common stock, $2,492 expenses, $2,100 bonus and indirect compensation; $21,800 debt securities; **R. Lehman,** director, no salary, 600 shares of common stock, 4,400 shares of common stock in the name of others, no expenses, $5,000 bonus and indirect compensation, $35,800 debt securities; **E. O. McDonnell,** director (until Jan. 6, 1960), no salary, no stock, no expenses, $100 bonus and indirect compensation; **M. T. McKee,** director, no salary, 200 shares of common stock, $5,547 expenses, $5,000 bonus and indirect compensation; **J. S. Rockefeller,** director, no salary, 2,500 shares of common stock, no expenses, $1,100 bonus and indirect compensation; **V. F. Taylor,** director, no salary, 2,000 shares of common stock, 1,500 shares of common stock in the name of others, $2,818 expenses; no bonus or indirect compensation.

Following firms or persons were paid for services rendered during 1960:

Paul Aiken, airmail traffic, $14,400; **Athearn, Chandler & Hoffman,** legal, $6,179; **Barnee Breeskin Enterprises,** public relations, $17,776; **Edward Larrabee Barnes Associates,** architects-design and development, $19,542; **Carb, Luria, Glassner & Cook,** legal, $25,000; **Cleary Gottlieb, Steen & Hamilton,** legal, $68,017; **Community Chests-various,** contributions, $35,980; **Danziger Brothers,** public relations, $6,000; **Dickie-Raymond, Inc.,** sales promotion, and advertising, $21,600; **Firestone Plantations Co.,** medical services, $5,111; **Sam Goldstein,** public relations, $11,171; **Graham, Green & Dunn,** legal, $5,042; **David E. Grant,** legal, $5,625; **Harvey Hancock,** public relations, $13,158; **William W. Holland Associates,** public relations, $7,314; **Immell, Herro, Buehner & Dewitt,** legal, $7,446; **Julius Klein,** public relations, $28,040; **Lehman Brothers,** underwriters, $175,000; **Lexwood Service,** public relations, $13,337; **The Liberia Co.,** representation, $6,000; **Lind Brothers,** printers, $14,449; **Lybrand, Ross Brothers & Montgomery,** audit, $127,532; **W. W. Marsh and Associates,** public relations, $5,860; **Lowell A. Mayberry,** labor relations, $14,837; **Richard P. Momsen,** legal, $5,574; **Mulhern & Mulhern,** legal, $6,000; **Carlos N. Parraga,** legal, $6,962; **Poletti & Freiden,** legal, $39,771; **Publicite Pan American, S. A.,** public relations, $11,999; **I. I. Raines & Co.,** sales consultants, $13,042, **Kimball Sanborn,** mail consultant, $13,660; **Sanderson & Porter,** engineering, $18,075; **Skadden, Arps, Slate, Meagher & Flom,** legal, $19,813; **Smathers, Thompson & Dyer,** legal, $12,423; **Steptoe & Johnson,** legal, $39,124; **Lowell Thomas,** public relations, $5,000; **Columbia University,** contribution, $5,000; **Cornell University,** contribution, $5,000; **Harvard University,** contribution, $5,000; **Johns Hopkins University,** contribution, $5,000; **Princeton University,** contribution, $5,000; **Stanford University,** contribution, $5,000; **Yale University,** contribution, $10,000.

Pacific Air Lines—J. H. Connely, president and director, $25,000 salary, 142,052 shares of common stock, $4,276 expenses; **T. R. Mitchell,** executive vice president and director, $20,000 salary, 2,229 shares of common stock, $4,904 expenses; **M. A. King,** vice president-sales, $11,600 salary, 220 shares of common stock, $3,810 expenses; **C. A. Myhre,** vice president-finance and director, $19,666 salary, 800 shares of common stock, $1,862 expenses; **H. S. White,** vice president-operations and director, $18,500 salary, no stock, $76 expenses; **H. L. Boros,** vice president-legal (Jan. 1, to Sept. 30, 1960), $9,000 salary, no stock, $450 expenses; **E. R. Dahl,** treasurer, $11,000 salary, 558 shares of common stock, $691 expenses.

R. E. Costello, vice president-traffic, $12,-854 salary, 450 shares of common stock, $1,924 expenses; **L. Hayward,** chairman of the board, no salary, 143,988 shares of common stock, $141 expenses, $100 bonus and indirect compensation; **F. L. Hendrickson,** assistant secretary, no salary, 5,000 shares of common stock, no expenses, $100 bonus and indirect compensation; **W. Roche,** secretary and director, no salary, 716 shares of common stock, no expenses; **J. Martin, Jr.,** director (from Mar. 28, 1960), no salary, no stock, no expenses; **W. Goetz,** director, no salary, no stock, no expenses, $100 bonus and indirect compensation.

Following firms were paid for services rendered during 1960: **T. I. Seamon,** legal, $27,792; **de Witt Conklin,** stockholder and financial relations, $5,851; **Washington Employers Service,** labor negotiator, $7,186; **Price Waterhouse & Co.,** accounting and auditing, $12,608; **Grant Advertising,** advertising, $201,737; **S. S. Colker & Associates,** legal, $11,253.

THE GRUMMAN GULFSTREAM
in a brand new "off-the-shelf" military transport version

- **for air evacuation**
- **for facilities inspection**
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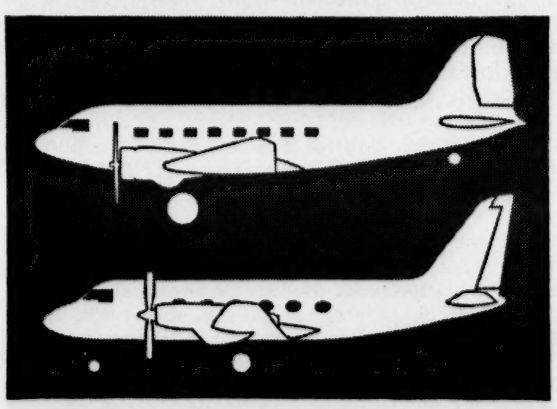
Military transports of World War II and Korea vintage performed admirably. But today they deserve to be retired as befits any battle-weary veteran.

Typical of such transports is the DC-3—one of the finest, most reliable airplanes of its day. Its size, and ability to land and take off from virtually any military field, made it an extremely flexible transport. It has served faithfully in many roles over the past 20 years and has proved to be an excellent military investment. The Grumman Gulfstream is ready to serve as the optimum in military transport for the *next* 20 years, and as a comparable investment.

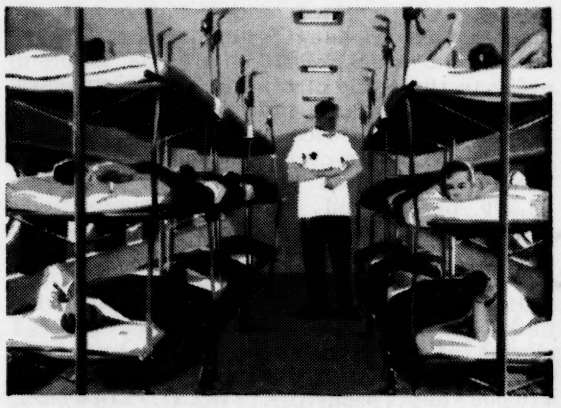
In the illustration, right, you see two airplane silhouettes: the first, a DC-3; the second, a Grumman Gulfstream. Note how closely they coincide in size. The Gulfstream is the modern pressurized, high performance replacement for the DC-3 and other older transports; equivalent to the DC-3 as a work horse transport—and costing even less to operate—the Grumman Gulfstream is a new airplane proved in service by over 60 world-wide corporations and the Federal Aviation Agency. Modernization of our country's airlift capacity for limited or brush fire warfare can be accelerated by the Grumman Gulfstream. And it's available *now*.



Gulfstream compared to DC-3

Facilities inspection

Here are the Gulfstream's capabilities: For military application, it will carry up to 24 passengers and has a transcontinental range against 50-knot head winds. It needs only 3,000 feet of runway, enabling personnel to use fields close to their destinations. It is completely independent of ground



Air evacuation

handling facilities. With its pressurization system (up to 30,000 feet), it flies above weather and traffic at a cruising speed of 350 mph and is powered by proven turboprop Rolls-Royce engines. An active development program is in progress at Grumman for the installation of the General Electric T64 turboprop engine as an alternate source of power.

Multipurpose Gulfstream cabin

GRUMMAN

AIRCRAFT ENGINEERING CORPORATION

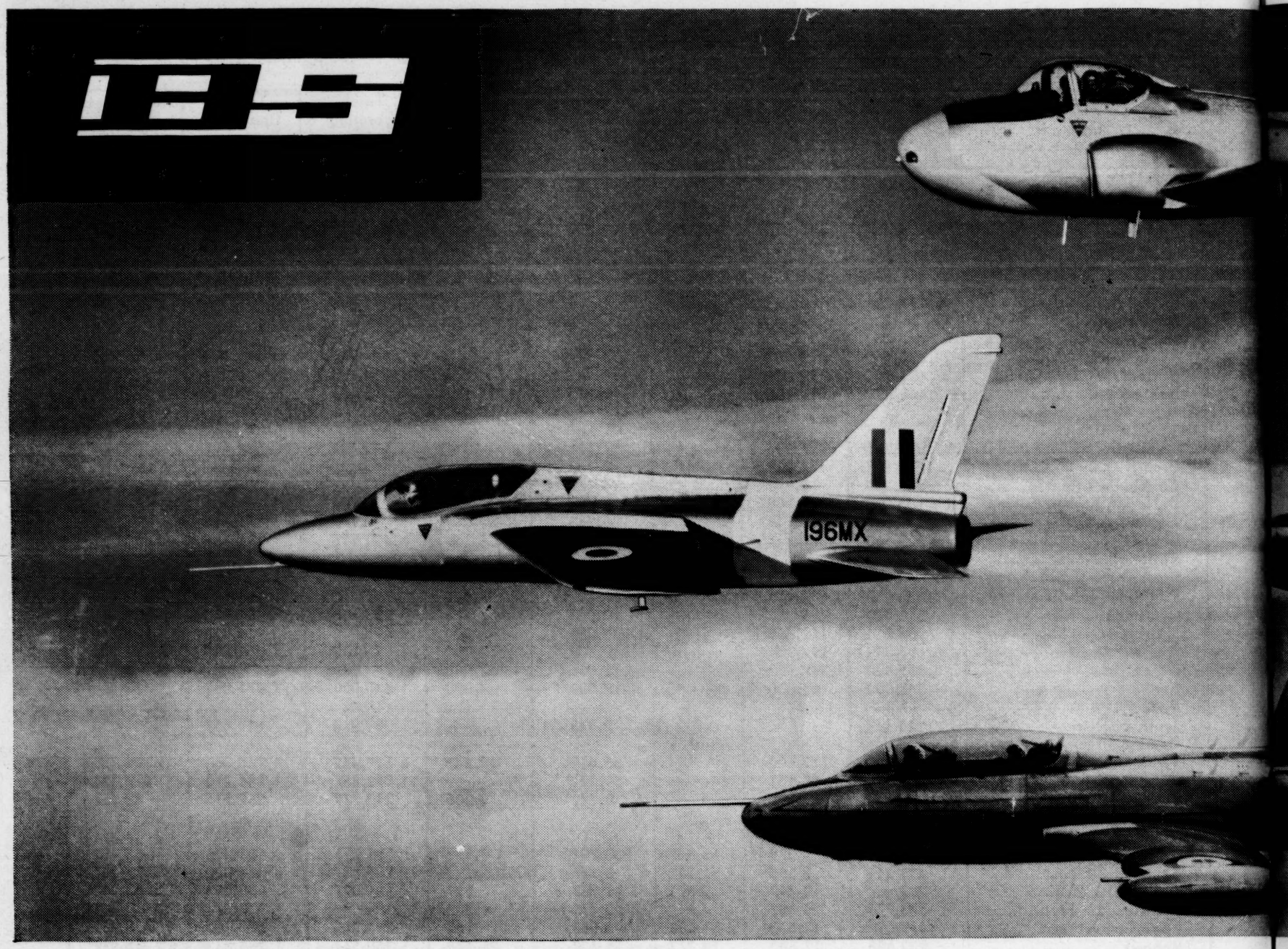
Bethpage • Long Island • New York

Airline Income and Expenses—April, 1961

(IN DOLLARS)

	Passenger Revenue	U.S. Mail	Express	Freight	Charter	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNKS								
American	31,047,129	670,585	335,476	1,888,859	.....	34,448,469	32,308,511	2,139,958
Braniff	5,729,534	117,531	58,881	198,161	42,796	6,235,426	6,135,133	– 37,481
Capital	8,174,027	198,197	110,339	152,278	.....	8,898,157	8,979,897	– 300,658[3]
Continental	4,635,000	86,000	38,000	128,000	44,000	5,029,000	4,699,000	120,000
Delta	12,709,000	201,000	90,000	327,000	.....	13,560,000	11,589,000	1,755,000
Eastern	22,420,747	498,920	.....	1,030,690[4]	13,204	24,140,442	23,655,263	164,928
National	5,694,384	86,911	35,313	203,486	85,311	6,282,588	5,989,860	120,157
Northeast[1]	.....	.....	.....	.....	.....	.....	.....	.....
Northwest[1]	.....	.....	.....	.....	.....	.....	.....	.....
Trans World	20,302,745	475,884	.....	1,337,017[4]	158,024	22,657,069	23,219,790	1,287,684
United	29,405,845	1,152,491	.....	2,291,335[4]	131,056	33,332,088	31,880,087	739,165
Western	3,446,723	57,185	.....	147,871[4]	17,816[6]	3,685,386	4,039,940	459,582
INTERNATIONAL								
American	480,761	7,346	496	62,504	.....	576,463	581,026	– 4,563
Braniff	730,961	31,108	.....	10,558	.....	859,722	1,165,449	329,911
Caribbean Atlantic	337,232	2,978	.....	14,472[4]	1,042	359,584	288,391	70,406
Delta	125,000	1,000	.....	4,000	.....	138,000	226,000	94,000
Eastern	2,823,149	60,146	.....	150,932	.....	3,035,179	2,871,622	223,295
Mackey	193,668	.....	692	5,388	.....	221,795	190,485	31,387[5]
National[5]	.....	.....	.....	.....	.....	.....	.....	.....
Northwest	.....	.....	.....	.....	.....	.....	.....	.....
Pan American Combined	26,435,000	2,609,000	.....	3,825,000	1,481,000	35,740,000	32,881,000	2,234,000
Alaska	278,000	15,000	.....	40,000	.....	338,000	464,000	–121,000
Atlantic	11,905,000	1,111,000	.....	1,533,000	395,000	15,605,000	15,925,000	–123,000
Latin America	6,197,000	194,000	.....	1,139,000	59,000	8,093,000	8,061,000	90,000
Pacific	8,055,000	1,289,000	.....	1,113,000	1,027,000	11,704,000	8,420,000	3,346,000
Panagra	1,348,000	65,000	.....	228,000	4,000	1,840,000	1,871,000	– 73,000
Resort[2]	.....	.....	.....	.....	.....	.....	.....	.....
South Pacific	86,144	756	.....	2,943	.....	89,974	119,651	–33,210
Trans Caribbean	.....	.....	.....	.....	.....	.....	.....	.....
Trans World	4,380,746	712,703	.....	735,619[4]	68,543	6,171,422	6,963,364	–1,308,720
United	1,663,164	88,151	.....	59,121[4]	.....	1,841,857	1,286,270	518,126
Western	201,238	3,206	.....	8,342[4]	3,206[6]	213,779	252,715	– 43,657
LOCAL SERVICE								
Allegheny	1,064,929	5,379	16,838	30,794	1,195[7]	1,686,901	1,633,478	53,423[3]
Bonanza	471,499	3,880	2,182	8,466	.....	749,842	644,200	71,234
Central	307,428	10,499	3,871	11,767	939	589,671	653,084	– 63,412[3]
Frontier	573,776	25,487	4,645	23,475	1,500	1,155,599	1,133,012	6,545
Lake Central	419,220	10,558	11,039	5,900	164	770,215	774,347	– 8,382[3]
Mohawk	932,698	17,685	12,277	16,129	21,173	1,350,544	1,266,333	45,039[3]
North Central	1,168,189	35,298	21,350	29,525	.....	1,916,788	1,960,589	– 65,084
Ozark	667,526	18,082	13,258	21,503	4,001	1,106,901	964,308	129,763
Pacific[1]	.....	.....	.....	.....	.....	.....	.....	.....
Piedmont	732,667	10,715	6,900	12,053	.....	1,158,993	1,075,911	59,527
Southern	463,583	17,076	5,717	12,194	2,239	842,284	797,026	36,111
Trans-Texas	459,324	12,403	5,889	19,826	7,028	828,454	825,715	– 2,769
West Coast	524,660	8,995	3,031	10,793	3,313	997,669	889,094	88,027
HAWAIIAN LINES								
Aloha	358,570	1,693	.....	5,050	.....	414,936	411,593	– 19,636[3]
Hawaiian	495,046	3,156	.....	67,551	.....	621,392	655,248	– 46,603[3]
CARGO LINES								
AAXICO[2]	.....	.....	.....	.....	.....	.....	.....	.....
Aerovias Sud Americana[1]	.....	.....	.....	.....	.....	.....	.....	.....
Flying Tiger[1]	.....	.....	.....	.....	.....	.....	.....	.....
Riddle[1]	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard World	.....	391,682	.....	658,464	559,157	1,620,614	1,839,088	–250,527[3]
Slick	.....	.....	.....	.....	861,630[8]	928,247	734,893	159,737[3]
HELICOPTER LINES								
Chicago Helicopter	121,419	131,514	.....	.....	.....	253,297	274,213	– 24,027
Los Angeles Airways	96,773	4,590	2,141	3,413	.....	302,151	337,689	– 37,809
New York Airways[1]	.....	.....	.....	.....	.....	.....	.....	.....
ALASKA LINES								
Alaska Airlines	171,353	59,660	1,400	33,485	229,874	699,248	686,814	9,612
Alaska Coastal	66,294	8,410	.....	9,172	5,170	171,319	164,246	5,015[3]
Cordova[1]	.....	.....	.....	.....	.....	.....	.....	.....
Ellis	54,000	4,000	.....	6,700[4]	1,700	115,200	105,300	9,000[3]
Kodiak	9,183	927	.....	1,571	5,015	20,017	29,279	– 9,794[3]
Northern Consolidated	67,714	93,837[9]	.....	32,115	5,979[7]	326,092	263,236	62,756[3]
Pacific Northern	480,713	88,920	3,596	92,512	.....	883,443	926,385	– 47,438
Reeve Aleutian	111,553	41,518	.....	35,629[10]	23,599	212,919	159,717	52,925
Western Alaska[1]	.....	.....	.....	.....	.....	.....	.....	.....
Wien Alaska	57,078	62,490[9]	.....	29,364	38,766	1,247,646[11]	351,582	76,087[12]
Avalon[1]	.....	.....	.....	.....	.....	.....	.....	.....
Samoan[1]	.....	.....	.....	.....	.....	.....	.....	.....

[1] Not Available [2] Operations Suspended [3] Net Profit or Loss [4] Property
[5] National's Service to Havana Suspended [6] Includes Other Transport Services [7] Non-Scheduled Transportation
[8] Includes Contract Flight Revenues [9] Service Mail Pay [10] Includes Excess Baggage
[11] Includes Back Subsidy Pay [12] Net Profit Without Back Subsidy Figured In.



5 of the world's foremost jet trainers selected for the afor

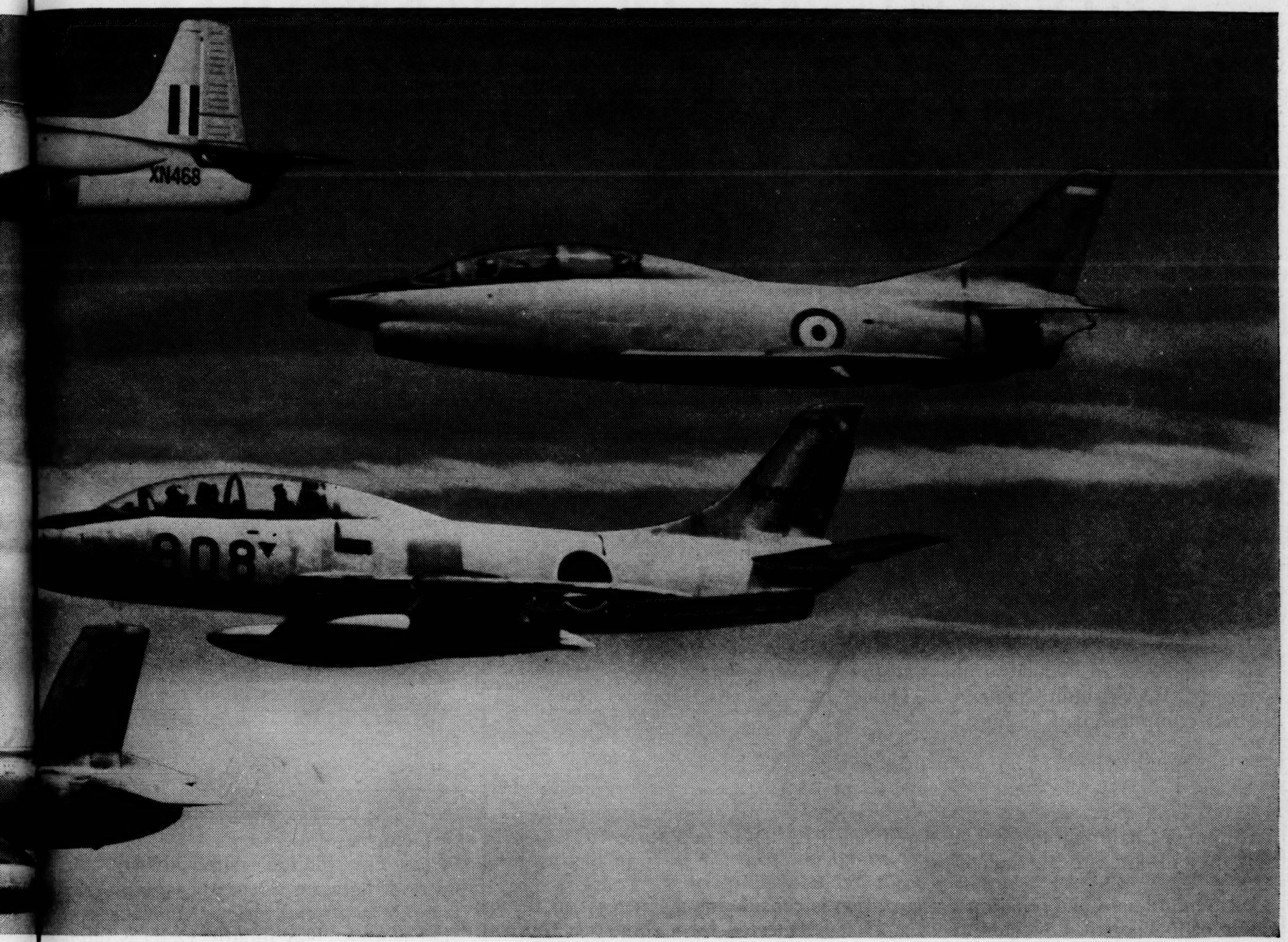
...AND BRISTOL SIDDELEY

One of the largest manufacturers of motive power units in the world, Bristol Siddeley Engines Limited produce the very successful Orpheus and Viper turbojets.

These engines power many different types of production aircraft, ranging from strike fighters to target drones. Specially adapted versions of the Orpheus and Viper have been developed to meet the stringent requirements of the new generation of jet trainers, and now power 5 of the world's foremost jet training aircraft which have already been selected for the air forces of Britain, Germany, Italy, Japan and Ceylon.

Manufacturing licence agreements for the Orpheus have been signed with France, Italy, India and Germany, and for the Viper with France and Italy.

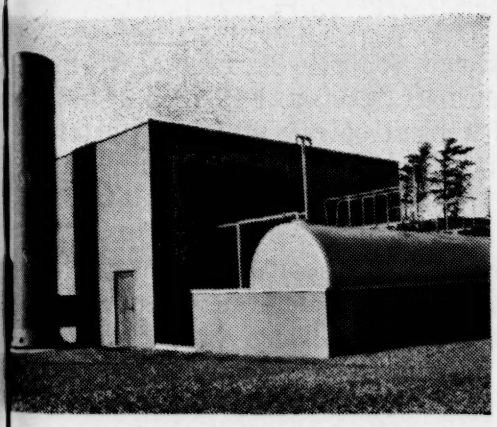
BRISTOL SIDDELEY ENGINES LIMITE

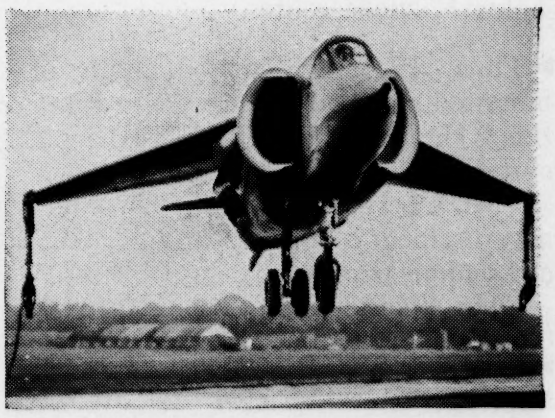


FROM L TO R: FOLLAND GNAT TRAINER — MACCHI MB 326 — HUNTING JET PROVOST TRAINER — FUJI TIF-2 — FIAT G 91T

aforces of 5 countries . . .

ESUPPLY THE POWER





OWER FOR THIS

e Bristol Siddeley Industrial Proteus turbine engine powers a 3,000-kilowatt bo-generator. Designed for peak-lopping l stand-by generation, this new pocket er station, two of which are in service, vers full power within 2 minutes of a l start for a lower capital cost than any er comparable type of installation.

. . . AND THIS

Bristol Siddeley Maybach diesel engines power Britain's crack express train—the British Railways "Bristolian". Two Type MD 650 engines, developing a total 2,200 hp, give the "Bristolian" a top speed of 90 mph. 286 Bristol Siddeley Maybach diesels have been ordered by British Railways alone.

. . . AND THIS

The Bristol Siddeley Pegasus lift/thrust turbofan powers the Hawker P 1127 strike aircraft—the world's first VTOL jet aircraft designed for operational service. Thrust is applied through four movable nozzles evenly disposed around the centre of gravity, providing a single power source for all conditions of flight.

ITE tol Aero-Industries Limited, 10210 Pie IX Boulevard, Montreal North, PQ, Canada.

AIRLINE OBSERVER

► Domestic trunkline revenue passenger miles continued to decline in May to reach the lowest monthly figure recorded for the industry since March, 1960. Total of 28.84 million revenue passenger miles registered in May was 2.6% below the volume handled in May, 1960. At the same time, available seat miles rose 5% to depress the industry load factor by 4.3 points. May's load factor of 54.66 is one of the lowest recorded by the industry in recent years.

► **Russia has agreed to start talks with the U. S. on a bilateral air transport agreement covering reciprocal traffic rights on a New York-Moscow route. U. S. has suggested July 18 as an opening day for the negotiations. Meanwhile, Pan American World Airways, certificated to operate the route, is financing Russian language courses for selected members of its staff. The carrier maintains, however, that it has set no target date for the opening of a Moscow office.**

► LOT, the Polish airline, has opened a sales office in mid-town Manhattan, the first carrier based behind the Iron Curtain to establish a U. S. sales office. The airline plans to begin transatlantic service "eventually."

► **Federal Aviation Agency is conducting Project Little Guy to draft standards for re-engineering the cockpits of light aircraft to protect pilots. Development of standard instrument and control configurations, which may be broadened to include airline transport cockpits, is a major goal of the project. FAA Administrator N. E. Halaby has asked the Project Little Guy study group to report by June 27.**

► Communist China claims to be making regular flights over a route network of about 27,945 mi., compared with about 23,000 mi. at the beginning of 1960. New routes opened during May totaled over 1,863 mi. and included Kunming-Chaotung and Peking-Kweiyang. Red China reports a 50% gain in over-all domestic air traffic during 1960.

► **International Civil Aviation Organization is considering an increase in the size of its council, now composed of 21 states elected for a three-year term to serve as ICAO's governing body. ICAO has grown from 26 states in 1947 to a current 86, and a number of members maintain that a council limited to 21 members no longer guarantees adequate participation.**

► Japan Air Lines will place one of its three Convair 880 turbojet transports in domestic service beginning in August. The aircraft was to have been operated on the southern route to Europe, but opening of this route has been delayed indefinitely. The two remaining Convair 880s will serve the southeast Asia route. Domestic service will include Tokyo-Sapporo and Tokyo-Fukuoka routes.

► **Three 15-ft.-high reproductions of Scotch whisky bottles have been mounted as an advertisement in front of the London Airport terminal, and this is the initial reaction in Parliament, as reported by Hansard, the official chronicler:**

"Mr. Chetwynd asked the Minister of Aviation why he approved the large advertisement for whisky immediately in front of the main terminal building at London Airport.

"Mr. Thorneycroft: for money."

► United Arab Airlines, national airline of the United Arab Republic, is interested in the Vickers VC-10 bypass transport for its projected transatlantic routes to North and South America. First goal is a route to New York via London. Once operating rights are obtained, the airline will use Comet 4Cs on the route until the VC-10 is available.

► **Boston radio station WEZE is reporting delays of more than 60 min. on all airline flights operating out of Logan Airport. The report is broadcast every hour on the hour.**

► Export-Import Bank has approved a loan of $8.1 million to help Air-India purchase two Boeing 707 transports. India will finance 20% of the $11.9-million purchase and The Boeing Co. will lend the airline $1.4 million.

SHORTLINES

► **Alitalia,** the Italian airline, has begun Douglas DC-8 service from Rome to Sydney, Australia, with one flight a week stopping at Teheran, Karachi, Bombay, Bangkok, Pnompenh, Cambodia and Darwin. The new service extends the Alitalia Far East route 6,500 mi. from Bombay to Sydney and replaces DC-7C service.

► **Bonanza Air Lines** reports a 27% increase in revenue passenger miles for May and a 21% increase in revenue passenger miles for the first five months of 1961 over the same period last year.

► **British Overseas Airways Corp.** reports it carried 790,718 passengers during the fiscal year ending Mar. 31, an increase of 32.3% over the previous fiscal year. British European Airways carried 3.9 million passengers during the same period, a 21.3% increase.

► **Civil Aeronautics Board** has approved a Caribbean Air Transport Assn. agreement continuing the present cargo rates in the Caribbean area for an indefinite period.

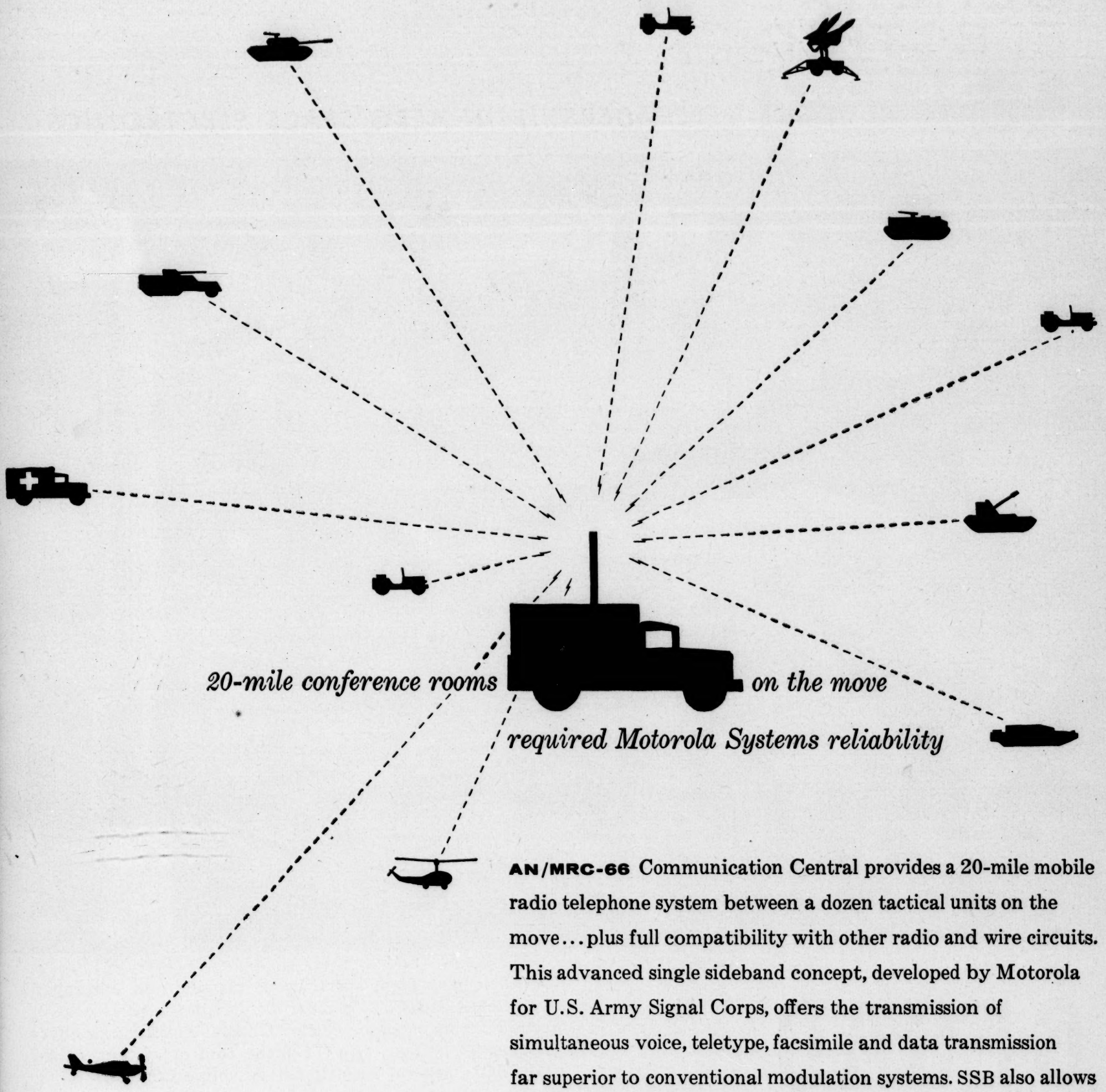
► **Delta Air Lines** reports a 28.1% increase in Florida traffic during the period between December and April despite a generally slow Miami season last winter. This month, Delta is offering 943 daily seats in and out of Miami, up from 844 seats last June.

► **Federal Aviation Agency** has begun using DME (distance measuring equipment) procedures on a nation-wide basis for the American Airlines jet fleet—the first carrier to be entirely equipped with DME (AW Apr. 3, p. 36).

► **Lockheed** reports its Electra turboprop aircraft serving 14 airlines have logged a total of 608,000 hr. Eastern Air Lines logged the most Electra time with 213,425 fleet hr.

► **Northwest Airlines** has installed the 81-D-1 teletype system in its new offices at Minneapolis-St. Paul International Airport. The system will relay sales, traffic and other information to one or more Northwest offices throughout the U. S. except certain off-route West Coast cities. If the teletype line is busy the equipment stores the message until the line is free.

► **Pacific Southwest Airlines** and Western Air Lines have been granted a 200-hr. overhaul extension to 1,800 hr. by Federal Aviation Agency for the Allison 501-D13 engines powering their Lockheed Electras.



20-mile conference rooms *on the move*

required Motorola Systems reliability

AN/MRC-66 Communication Central provides a 20-mile mobile radio telephone system between a dozen tactical units on the move... plus full compatibility with other radio and wire circuits. This advanced single sideband concept, developed by Motorola for U.S. Army Signal Corps, offers the transmission of simultaneous voice, teletype, facsimile and data transmission far superior to conventional modulation systems. SSB also allows more channels in a given portion of the crowded RF spectrum and more systems in a given area. ☆ Automatic Output Control insures uniform signal reception regardless of whether vehicles are deployed 100 feet or 10 miles from the Central. Three operating modes—Normal, In-Channel Net and Emergency Net—enhance the basic system flexibility. ☆ Simplification inherent in Motorola's concept and modular design affords the highest possible degree of reliability and maintainability in the field. Detailed information is available on request.

Military Electronics Division **MOTOROLA**

Qualified technical personnel are invited to apply

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GENERAL ELECTRIC

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GESAC

New flight control system is fully self-adaptive, performance-proven in flight testing

A whole new flight spectrum of manned and unmanned vehicles is at hand. To meet the unique range of control requirements of these vehicles, General Electric now offers a completely new type of flight control system, called GESAC. (General Electric Self-Adaptive Control.)

A knowledge of the detailed aerodynamic characteristics of a missile or aircraft is not required to apply GESAC to the vehicle. Thus, both flight testing and application engineering effort can be sharply reduced.

No external air data sensors or computers are required for gain changing.

GESAC has already been successfully flight-tested aboard the Convair F-106 under Navy Bureau of Weapons sponsorship. An evaluation of extremely rigorous re-entry profiles has been conducted on the North American/NASA X-15 Simulator under Air Force contract, with outstanding success. A flight evaluation on the McDonnell F4H-1 is currently in progress under Navy BuWeps contract. GESAC provides another example of Light Military Electronics Department leadership in aero/space electronics.

150-03

GENERAL ELECTRIC

Light Military Electronics Department

Armament & Control Section, Johnson City, New York

MOCKUP of the Sud 3210 Super Frelon helicopter on order by West Germany and the French navy shows its six-blade main rotor configuration and rear cargo loading ramp. As a cargo vehicle, 3210 would transport two small military-type vehicles in its cabin over a range of 373 stat. mi. As a troop carrier, it would accommodate 27 troops.

Super Frelon Offers More Speed, Payload

By Cecil Brownlow

Paris—Sud 3210 Super Frelon designed to help fill the West German and French navy heavy-turbine helicopter needs represents a major step beyond the two predecessor 3200 Frelon prototypes now rounding out their flight test evaluations. Germans plan to order 150 3210s (AW June 19, p. 34).

Differences between the two touch almost every aspect of design, ranging from fuselage construction and positioning of fuel stores to rotor configuration, payload, speed and engine power. Envisioned changes include:

• **Incorporation of six-blade** main rotor system capable of handling higher gross weights as a substitution for the four-bladed rotor installed on the 3200 prototypes. Diameter of the Super Frelon main rotor system is 62 ft. as opposed to 49.2 ft. for the 3200. Other advantages of six main blades include the ability to attain higher maximum and cruise speeds as well as lower stall speeds because of the reduced angle-of-attack needed in forward flight.

Sikorsky Aircraft Division of United

FOUR-BLADED PROTOTYPE of the earlier 3200 Frelon, predecessor of the 3210, demonstrates its maneuverability in Paris Air Show flyby. Unlike the 3210, the 3200 carries all its fuel externally in tanks mounted to each side of the fuselage. Two prototypes of the 3200 have been built and are under test.

Aircraft Corp., which began testing the six-blade rotor principle two years ago on a modified S-56, is working closely with Sud on a technical assistance level in the Super Frelon program. Sikorsky S-64 Flying Crane, first prototype of which is scheduled to roll out early next year, also will use the six-blade main rotor system.

• **Substitution of five-blade** tail rotor unit with a diameter of 12.5 ft. to replace the four-blade system on the 3200 which has a substantially smaller diameter.

• **Increase in maximum speed** to 155 mph. from about 131 mph. for the Frelon and a boost in cruising speed to 137 mph. from 124 mph.

• **Expansion of maximum gross weight** to 25,350 lb., normal gross to 24,200 lb., as opposed to 17,640 and 16,530 lb. respectively for the 3200. Maximum gross weight of the S-64, which also is scheduled to be used by the West German military, is 38,000 lb. Empty weight of the Super Frelon is 13,200 lb.

• **Placement of fuel tanks** within the fuselage below the floor level. Fuel for the 3200 is carried externally in tanks mounted to each side of the cabin. Super Frelon has three standard internally-housed fuel cells capable of holding 290 U.S. gal. each, and additional tanks can be housed in the fuselage for ferrying purposes.

• **Adaptation of three Turbomeca** Turmo IIC shaft turbine engines of 1,320 shp. each and a growth potential to 1,500 shp. for the Super Frelon. Frelon 3200 prototypes are powered by three Turmo IIIBs of 800 shp. each. In both instances, two engines are located side-by-side in front of the gear box above the cabin, the third behind the gear box. To increase the growth potential possibilities of the 3210, the Super Frelon transmission system is being built to handle a maximum of 3,300 shp. on continuous power and 3,600 shp. for takeoff.

• **Use of an amphibian hulled** fuselage on the 3210 to meet navy requirements as opposed to the standard boxed body of the 3200.

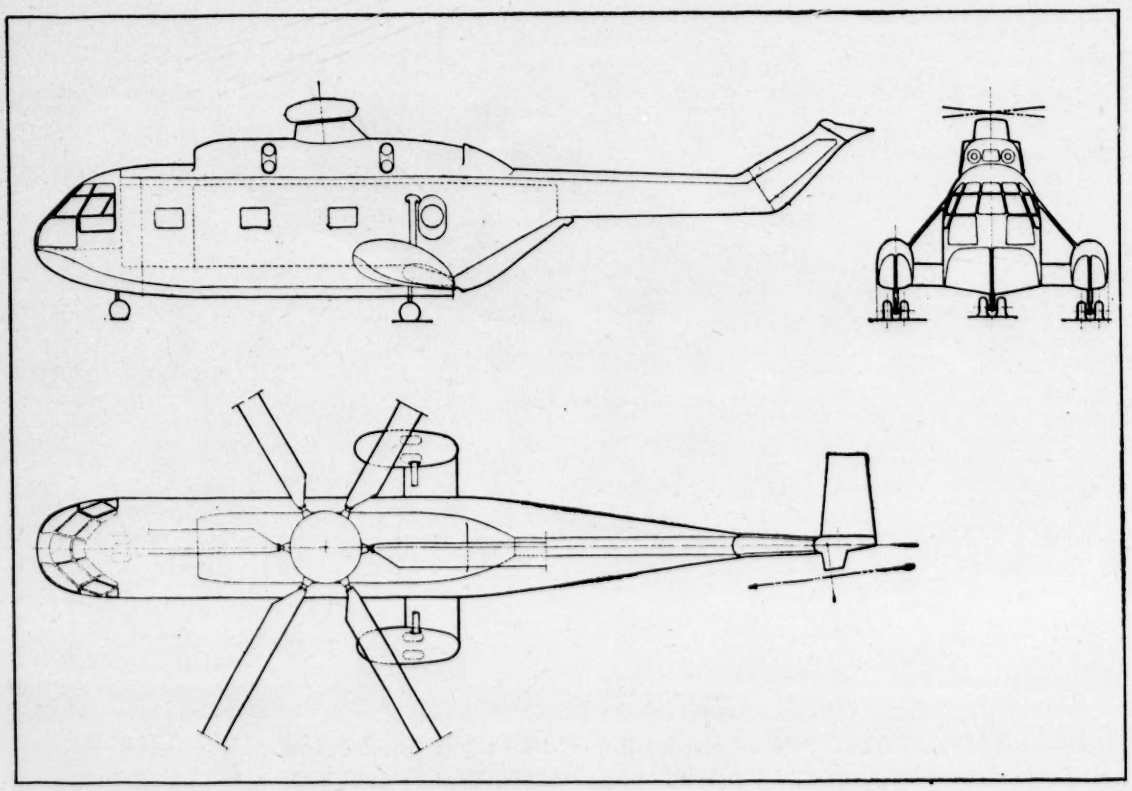
In keeping with its increased maximum and normal gross weights, the Super Frelon will be capable of ferrying 27 troops or 18 litter patients plus two attendants as opposed to the 24 troops or 15 litter patients and attendants of the 3200.

Maximum sea-level range of the 3210 Super Frelon at a normal gross weight of 24,200 lb. including a full 870 gal. of fuel at takeoff is 495 naut. mi. with 30 min. reserve. As a cargo carrier, the 3210 can transport two jeeps weighing a total of 6,600 lb. over 324 naut. mi.

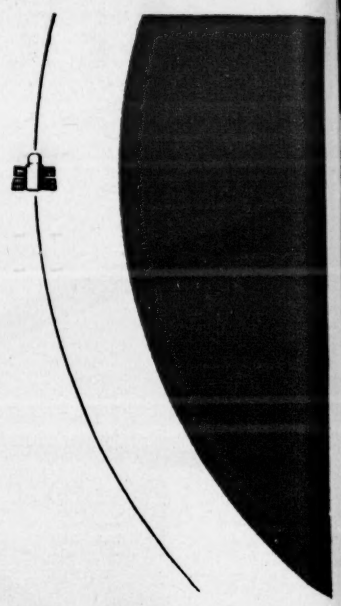
Fitted for anti-submarine duty, with a dipping sonar unit lowered from its housing within the cabin and with a torpedo located on either side of the fuselage, the Super Frelon has a search capability of 3 hr. with 30 min. reserves when operating within a radius of 40 naut. mi. from its home base. Operating at a radius of 160 naut. mi. from its base, the 3210 can remain in the search area for approximately one hour. Both figures envision the helicopter taking off at its maximum gross weight of 25,350 lb.

In still another configuration equipped with a hoist system, the Super Frelon can carry a maximum load of 9,900 lb. Vertical lift rate of the hoist system is one foot per second.

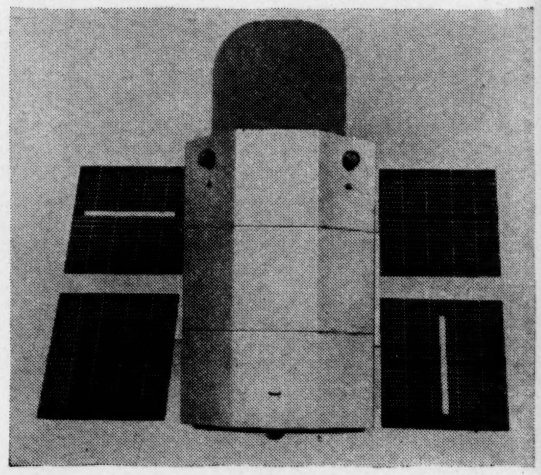
Maximum length of the Super Frelon with blades folded is 55.7 ft. as compared with 48 ft. 10½ in. for the 3200. Super Frelon width with blades folded is 17.2 ft., or about 2



SUPER FRELON is 55.7 ft. long, 17.2 ft. wide and 16.24 ft. high with rotor blades folded. Rotor is 62 ft. in dia. Cabin is 6 ft. high, 6.2 ft. wide, 22.9 ft. long.



ASTRONOMICAL SATELLITE



National Aeronautics and Space Administration's Astronomical Observatory will be launched 500 miles into space in 1963. It will orbit above the screen of Earth's atmosphere, which distorts and absorbs radiation from stellar objects. Observations through a 36 inch telescope from this vantage point will provide astronomical data unavailable from any ground-based equipment.

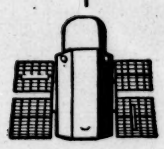
Initial Stabilization—Within five hours after reaching orbit, the Astronomical Satellite's stabilization and control system will eliminate tumbling and roll, and orient its optical axis away from the sun. Reference to a predetermined star pattern will verify initial stabilization.

Accurate Stabilization—Next, the satellite will be pointed and held to within 1.0 minute of arc, using feedback from the system's six star-trackers. Feedback from experimental optics will then be used to stabilize the satellite within 0.1 seconds of arc.

General Electric's Missile and Space Vehicle Department is developing the stabilization and control system for the Astronomical Satellite. Similar systems for Atlas and Thor re-entry vehicles, and Advent and Nimbus satellites have already been designed by MSVD . . . a department of the G.E. Defense Electronics Division.

160-09

GENERAL ELECTRIC

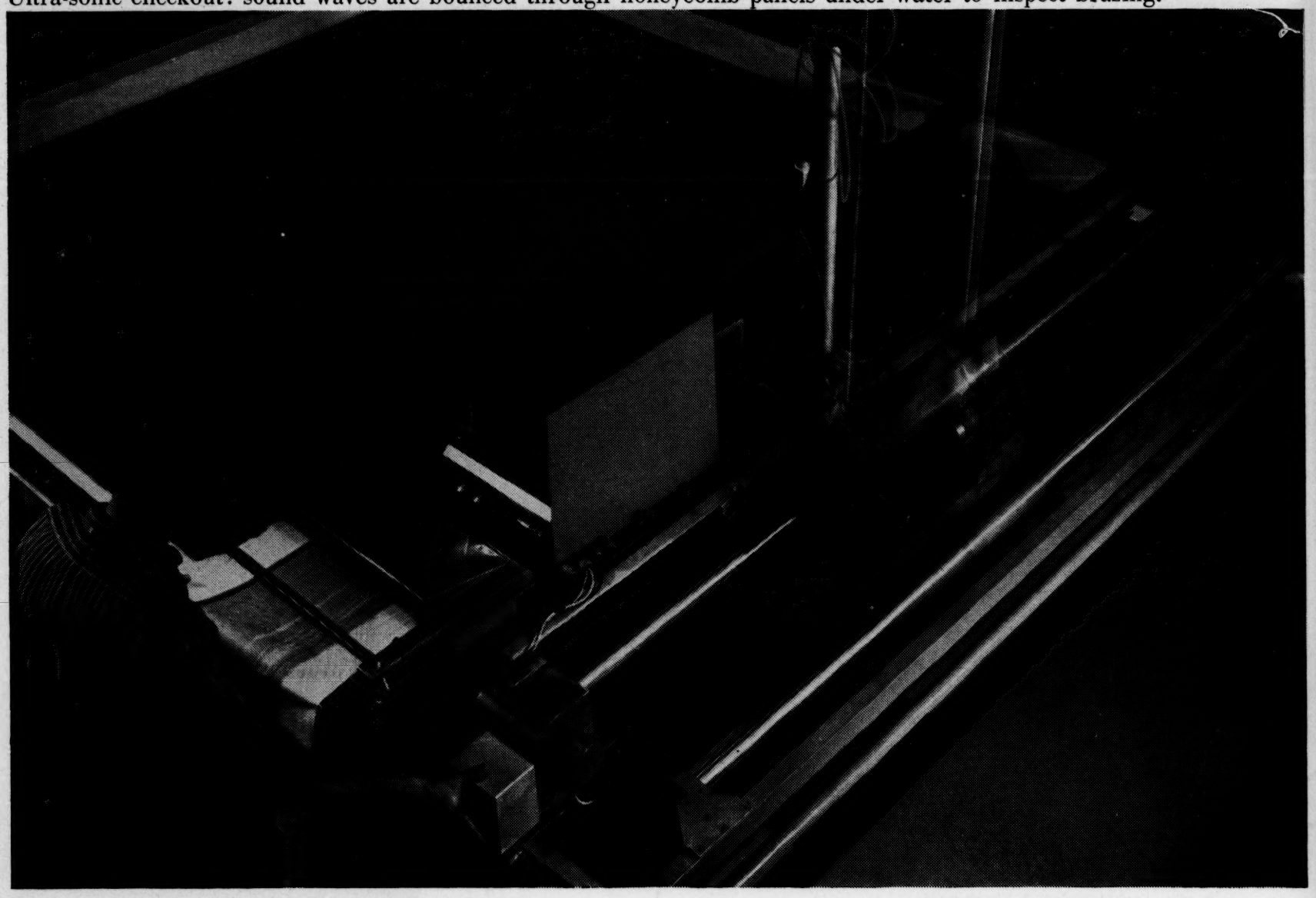


ASTRONOMICAL SATELLITE will orbit beyond Earth's atmospheric haze—historic barrier to man's study of stars. Once this NASA satellite is stabilized in orbit, its ground-controlled telescopic and electronic equipment can automatically observe, collect and transmit data. The control and stabilization system for this orbiting astronomical observatory is being developed by General Electric's Missile and Space Vehicle Department for Grumman Aircraft Engineering Corporation, prime contractor for the Astronomical Satellite.

GENERAL ELECTRIC

MISSILE AND SPACE VEHICLE DEPARTMENT, PHILADELPHIA, PA.

Ultra-sonic checkout: sound waves are bounced through honeycomb panels under water to inspect brazing.



Mach 3 Manufacturing

Sounding out the inner secrets of brazed honeycomb panels

Manned aircraft are built with brazed panels of stainless-steel honeycomb in order to fly for hours at supersonic speeds. But inspection of these panels becomes a major problem because the interior of brazed honeycomb panels cannot be seen.

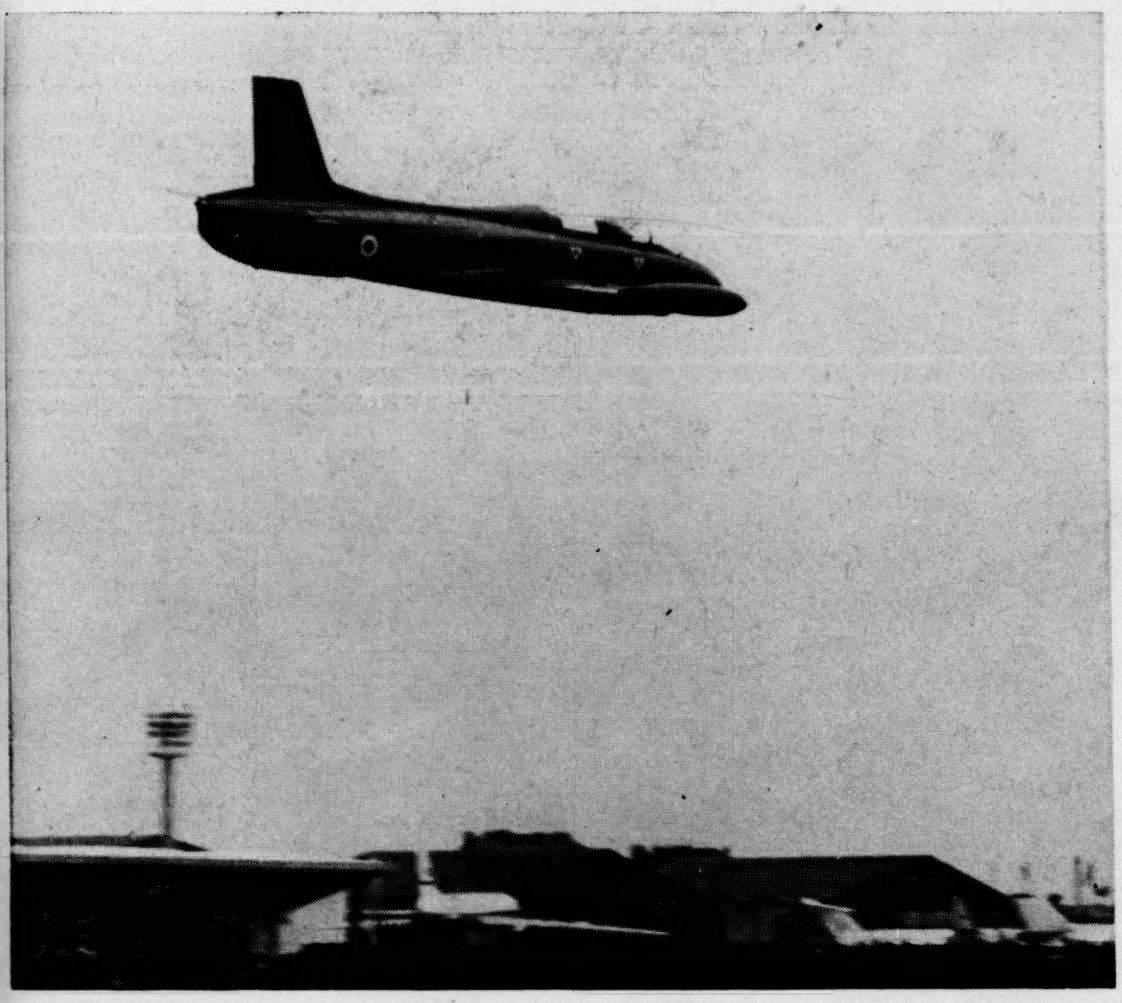
To solve this problem in designing the Air Force's new B-70 Valkyrie airplane, a special Quality Control Development Program was undertaken at the Los Angeles Division of North American Aviation.

The result: ultra-sonic inspection, a process that works like the Navy's sonar systems for locating submarines. By immersing each finished panel into a tank of water and then traversing a scanning head over it, sound waves are transmitted into the panel and reflected back to the scanning head. The reflections are recorded on photo-sensitized paper for a permanent record of every minute area where honeycomb and skin are brazed together. Any area that has been improperly brazed will show up instantly.

This method of inspection is just one of the many processes and advances in Mach 3 manufacturing that have been evolved by North American development programs. Other advances cover the full spectrum of triple-sonic fabrication. As a result of these programs, North American Aviation has met the challenge of Mach 3 manufacturing.

Builders of the B-70 Valkyrie

THE LOS ANGELES DIVISION OF **NORTH AMERICAN AVIATION, INC.**



Italian Macchi 326 Makes Pass at Paris Show

Macchi 326 two-place Italian jet trainer makes pass over Le Bourget Airport during 24th Paris International Air Show. Pilot Guido Carestiato pulled 4g in inverted climb-outs at low altitudes near the crowd and was not allowed to fly the aircraft in the final day's demonstrations at the air show (AW June 19, p. 117).

in. wider than the 3200 prototypes. Height is 16.24 ft. as opposed to 15.5 ft. for the 3200.

Cabin dimensions for the Super Frelon are: height 6 ft., width 6.2 ft. and length 22.9 ft. With the rear ramp lowered for cargo purposes, clearance of the fuselage opening is 5 ft. in height, 3.93 ft. in width. The cargo version also includes an internal pulley system for towing stores aboard, and the ramp can be either lowered to the ground or stopped hydraulically at a point flush with the cabin floor to facilitate loading and offloading from trucks and other vehicles.

Operating at a normal gross weight of 24,200 lb., the Super Frelon is designed to have a hovering ceiling out of ground effect of slightly over 9,000 ft. Hovering ceiling in ground effect is listed at 10,500 ft. Service ceiling is 12,000 ft. Design sea-level vertical rate of climb is 11 fps. Sea-level rate of climb in forward flight at maximum power is 36 fps.

Production of the first two pre-production models of the Super Frelon has just begun at Sud's La Courneuve factory near Paris. Once the final design changes have been made and full production is begun, the manufacturing will be split among companies in Germany and Italy as well as France under present plans.

Sud and Germany's Weser Flugzeugbau probably will divide the production of the fuselage sections, while Italy's Fiat, already building rotor sections for the Sikorsky S-58 under license, is expected to play a major role in the manufacture of rotor head components.

Division of production among the nations follows the tenets of a 1958 pact between the three for mutual development and production of a helicopter family. The agreement also played a major role in West Germany's final decision on the Super Frelon over the U. S. Sikorsky S-61 and Vertol 107 in a political-technical competition that stretched over almost a year.

As an interim measure to help meet its requirements until 3210 deliveries begin in the mid-1960s West Germany will receive a quantity of S-58s under an agreement worked out between the U. S. and German governments.

Plum Brook Nuclear Reactor Goes Critical

Plum Brook nuclear test reactor went critical June 14, generating a few watts to calibrate instruments and equipment. Output of NASA's Sandusky, Ohio, facility will gradually be increased to 100 kw., and then be shut down for final inspection. Operating reactor power will be 60 mw.

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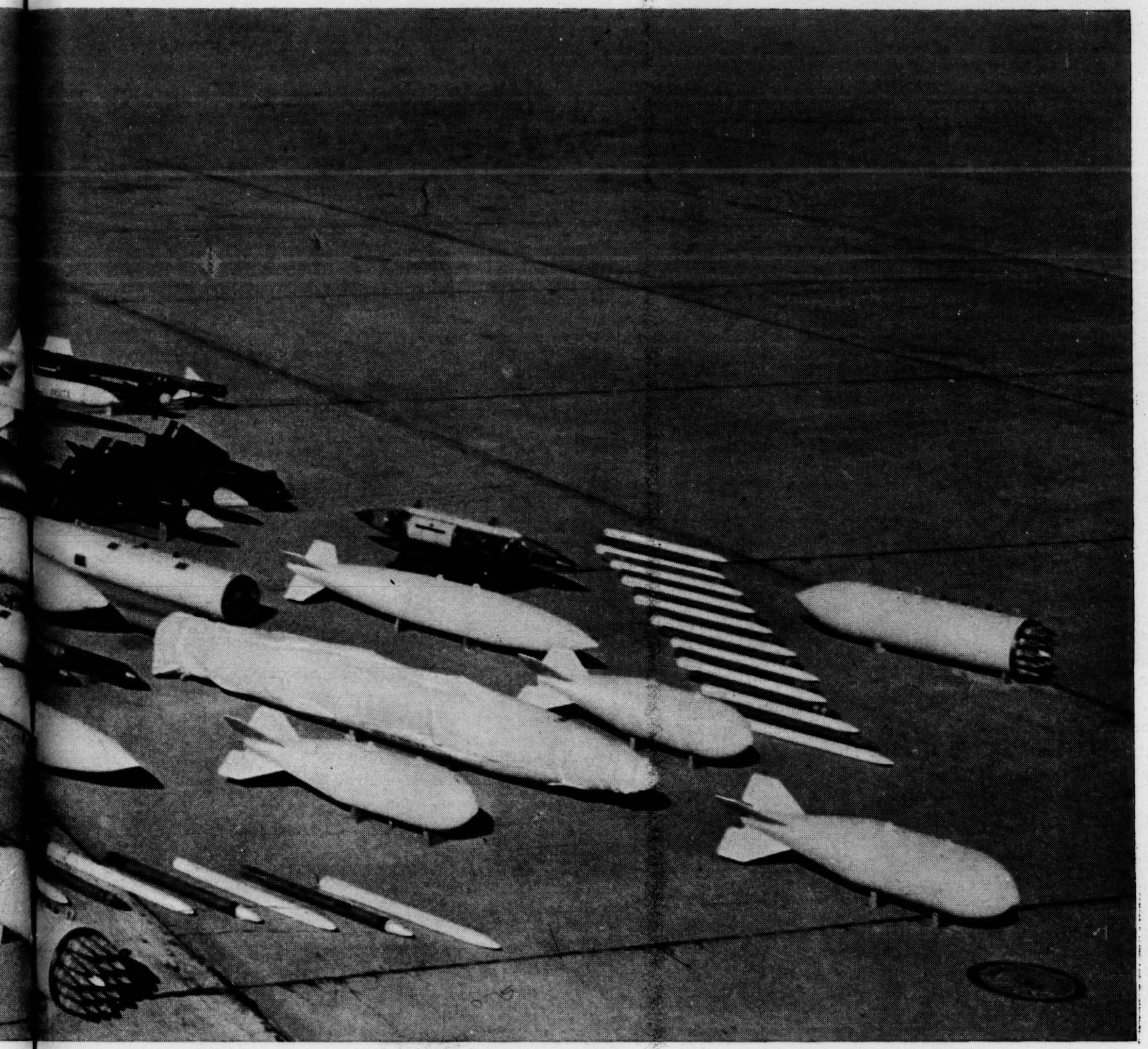
LIGHTWEIGHT FIGHTER WITH

Here is the Northrop N-156...a bold new concept in fighter weapon systems

The twin-jet supersonic Northrop N-156 is more than an aircraft; it is a complete family of lightweight fighter weapon systems designed to fulfill the many air support roles of limited war: close support of ground forces, reconnaissance and surveillance, interdiction, air defense and air superiority. The N-156 can be deployed from the United States zone of interior to any point in the world within 24 to 48 hours. It can then be dispersed throughout the theater of operations, utilize advance bases with short, unimproved runways, and operate with minimum logistic support, fast turnaround and extremely low maintenance downtime.

Its high performance, extreme maneuverability and ease of handling have won the Northrop N-156 unanimous acclaim as a "pilot's airplane." An exceptionally safe and reliable aircraft with unusual aerodynamic stability, it can accomplish its mission, return and land safely with one engine out. Very low fuel consumption eases the storage and resupply problems likely to plague advance areas. Maintenance and service can be easily accomplished from ground level without



A HEAVYWEIGHT PUNCH

designed specifically for limited warfare... ready now.

crew stands. In short, from both a tactical and logistic point of view, the N-156 is ideally suited to the mission requirements and problems of limited warfare.

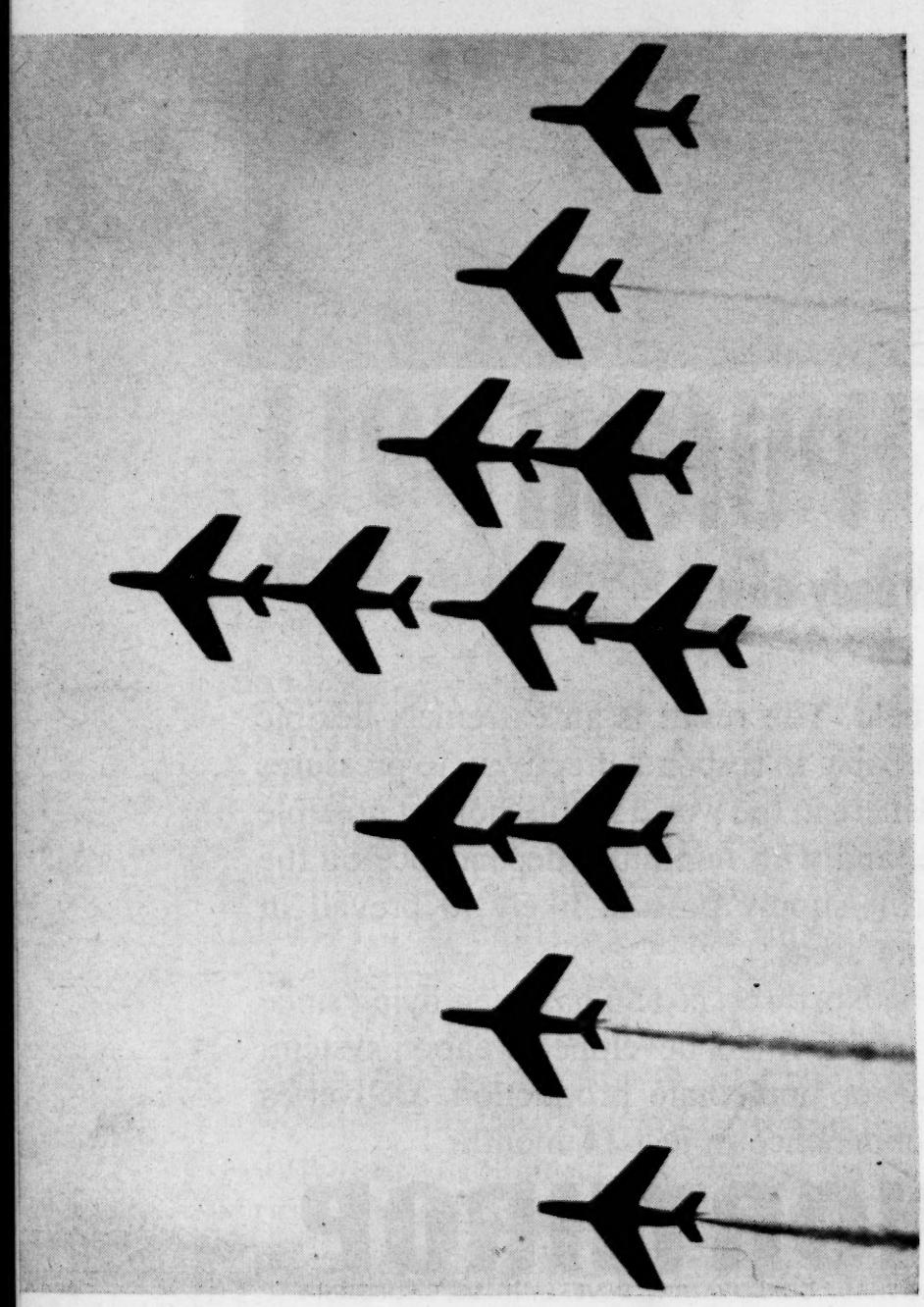
The economics of the Northrop N-156 are also highly favorable for limited warfare. Low initial cost plus exceptionally low operating and maintenance costs make it possible to greatly increase the number of units in the field for the same budget dollar. Simplicity of maintenance also reduces the number of trained personnel, the amount and complexity of ground support equipment needed in the field. The result is an extremely flexible force, able to respond effectively to pressures anywhere in the world in the shortest possible time, and with minimum dependence on the difficult supply posture likely to prevail in remote areas.

The Northrop N-156 has been flying since July 1959. It is a developed weapon system, ready for immediate production. Deliveries can commence in just 14 months.

NORTHROP

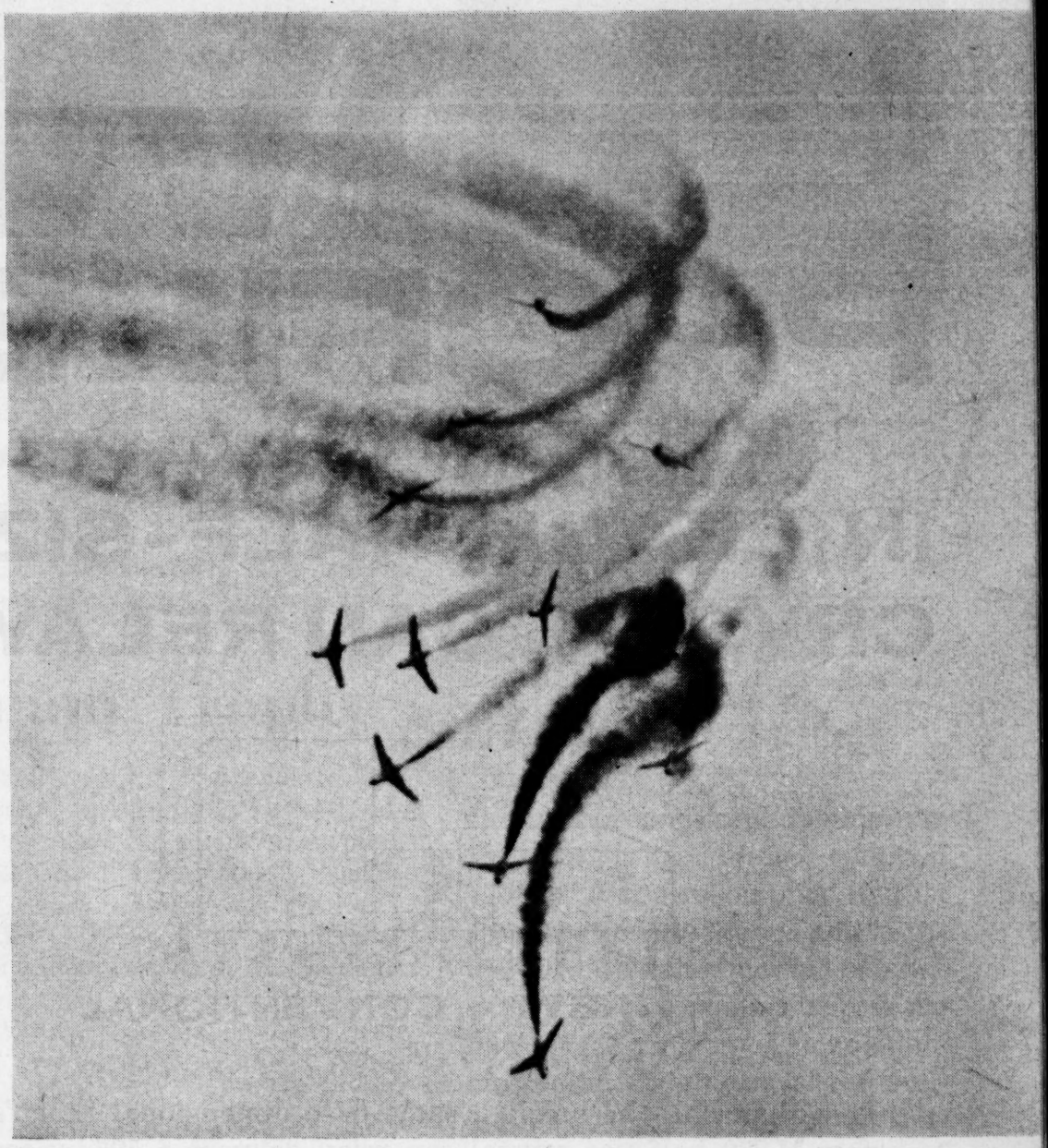
NORTHROP CORPORATION, BEVERLY HILLS, CALIFORNIA

Patrouille de France, French air force aerobatic team led by Capt. Jean Brieu, displays the tricolor red, white and blue paint scheme on their Dassault Mystere IV supersonic fighters in formation flyby at the 24th Paris Air Show at Le Bourget. Note low man in the 12-plane formation sliding out of position.

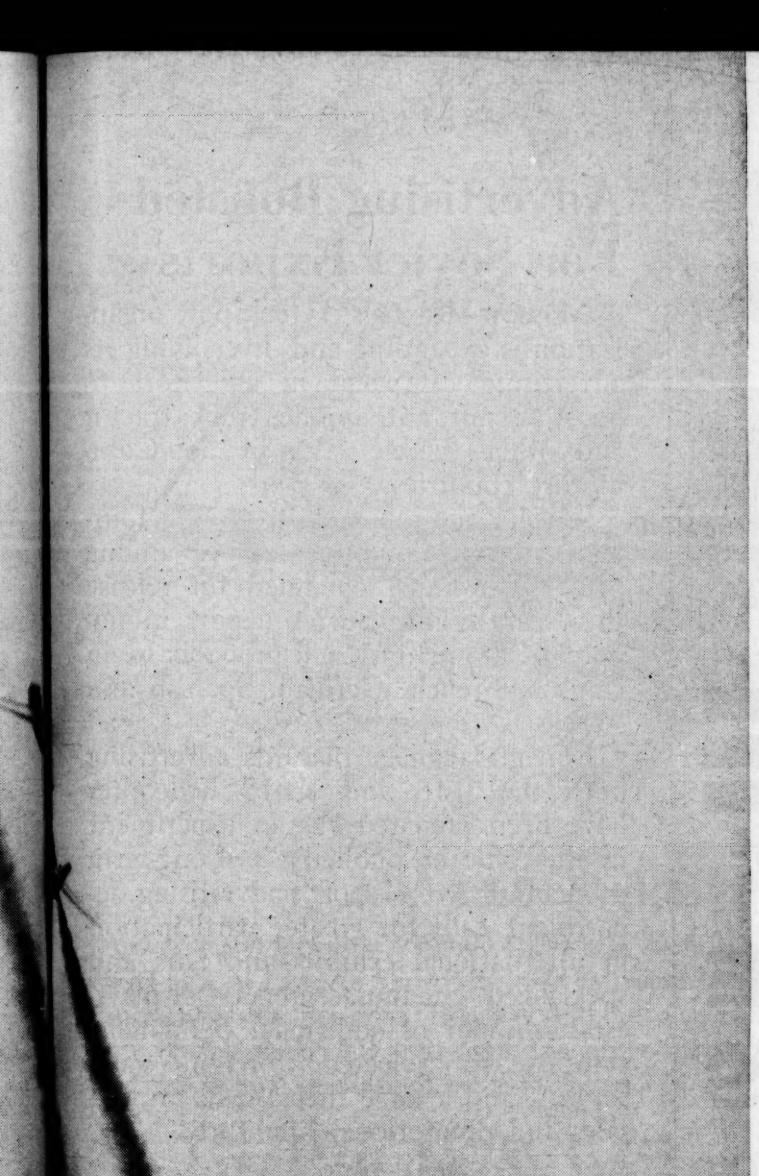


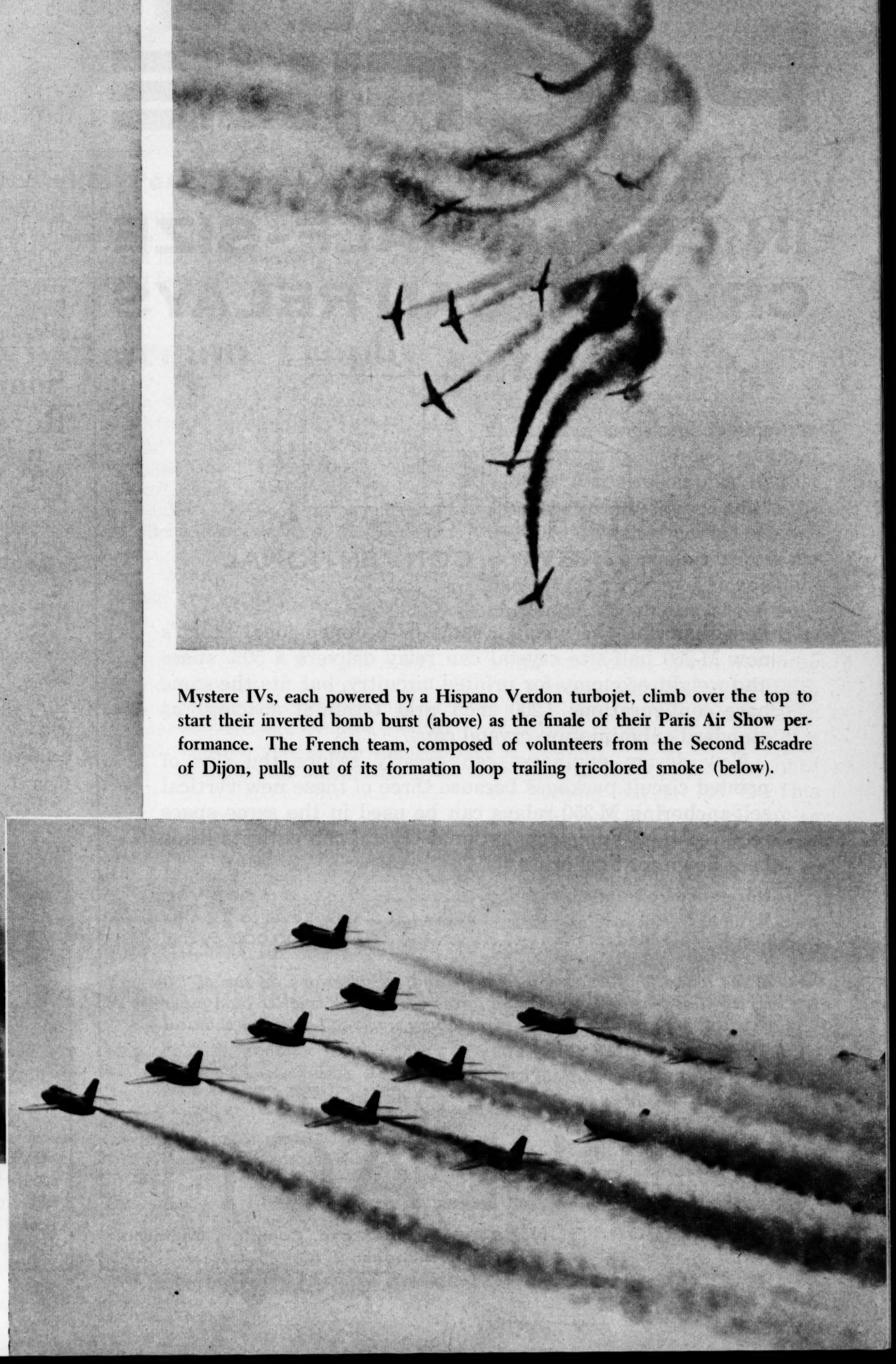
French Acrobatic Team Performs With Mystere IVs

Patrouille de France pulls up into formation loop (above) with its 12-plane formation trailing red, white and blue smoke to form the French tricolor. One plane is almost obscured by the smoke trails. Group also did formation rolls. In a tight



Mystere IVs, each powered by a Hispano Verdon turbojet, climb over the top to start their inverted bomb burst (above) as the finale of their Paris Air Show performance. The French team, composed of volunteers from the Second Escadre of Dijon, pulls out of its formation loop trailing tricolored smoke (below).

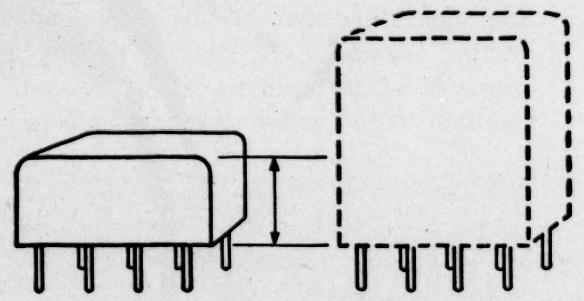




arrowhead formation (left), the Patrouille de France flashes by the crowd of 250,000 on the final day of the flying exhibition.

NEW LOW PROFILE

IN LEACH HALF-SIZE CRYSTAL CAN RELAYS



NEW CONVENTIONAL

Less than half the height...same base dimensions! Leach's new M-250 half-size crystal can relay delivers a 50% space and weight economy for printed circuitry, but fits the same base configurations (.200 inch grid terminal spacing) as standard subminiature crystal cans.

Now design engineers can greatly reduce the size of printed circuit packages because three of these new vertical self-anchoring M-250 relays can be used in the same space required by a single conventional crystal can with its leads bent down for anchoring.

Normal coil operating voltages..... 6 to 26.5 VDC
Contact rating @ 26.5 VDC ..... Low Level to 2 Amps
Life @ rated load..... 100,000 cycles

Write today for further information and specifications on the M-250 series—less sensitive to vibration forces because it's smaller than other relays...more reliable because it contains a single-coil electromechanical circuit instead of two coils.

LOOK TO LEACH

LEACH CORPORATION, 18435 Susana Road, Compton, California
EXPORT: Leach International, S.A.

Advertising Boosted For Soviet Exports

Moscow—Russia's Avtoeksport organization is expanding and diversifying its advertising campaign in an effort to boost aircraft, automobile, truck, tractor and other vehicle sales in non-Communist countries.

A color motion picture on the four-turboprop Il-18 transport is among three such films scheduled for release this year by the Soviet export monopoly. Commentary will probably be in English, French, German, Spanish and Arabic.

Foreign-language placards advertising both the Il-18 and Ka-18 helicopter have been prepared "as an experiment in this type of publicity." Long-term program of Avtoeksport's advertising department calls for greater participation in international exhibits and fairs and specialized manufacturers' displays, establishment of additional permanent exhibits in selected foreign trade centers, and a large increase in printed sales and promotional literature.

Sonic Barrier Crashes Revealed by Russians

Moscow—Details of Russian jet aircraft catastrophies which occurred during the Soviet attempt to crack the sonic barrier following World War II are just being revealed to the public.

Material on the subject is contained in a new book, "Through Invisible Barriers," by test pilot M. L. Gallai.

Gallai tells how "several" Soviet jets "came apart in the air from the sudden development of vibration at high subsonic speeds." Among those "who fell owing to flutter" in the MiG-9—first Soviet jet fighter—was A. N. Grinvik, who made the initial flights in the twin-engine craft.

Russian citizens' interest in the long-concealed facts of Soviet jet aviation development is so intense that the entire 15,000-copy printing of Gallai's book "disappeared from store shelves instantaneously."

Soviet Space Chief

Konstantin N. Rudnev has been appointed chairman of the Soviet State Committee for the Coordination of Scientific Research, the top missile and space post in the USSR.

Rudnev, promoted from his former post as chairman of the Council of Ministers for Defense Technology, succeeds M. V. Khrunichev, who died earlier this month (AW June 12, p. 36). Leonid Smirnov replaces Rudnev in the defense post.

Known to rout hawks a hundred times his size, the hummingbird is a creature of courage. But when he takes this risk, it is with a distinct advantage. His powers of flight are matched by none.

We admire his style. And we share the philosophy. Knowing that our own capabilities are highly distinctive, we too believe that they are a thing to be used with boldness. Two years ago, Fairchild pioneered commercial production of diffused silicon Mesa transistors. They became the industry's most widely copied types. But we developed direct replacements — silicon PLANAR transistors (PLANAR diodes too were developed) — another step forward. Our newly introduced PLANAR EPITAXIAL devices and MICROLOGIC elements continue the progress.

We have many ambitious programs ahead. If you like our approach and have a relevant background, we would like to hear from you.

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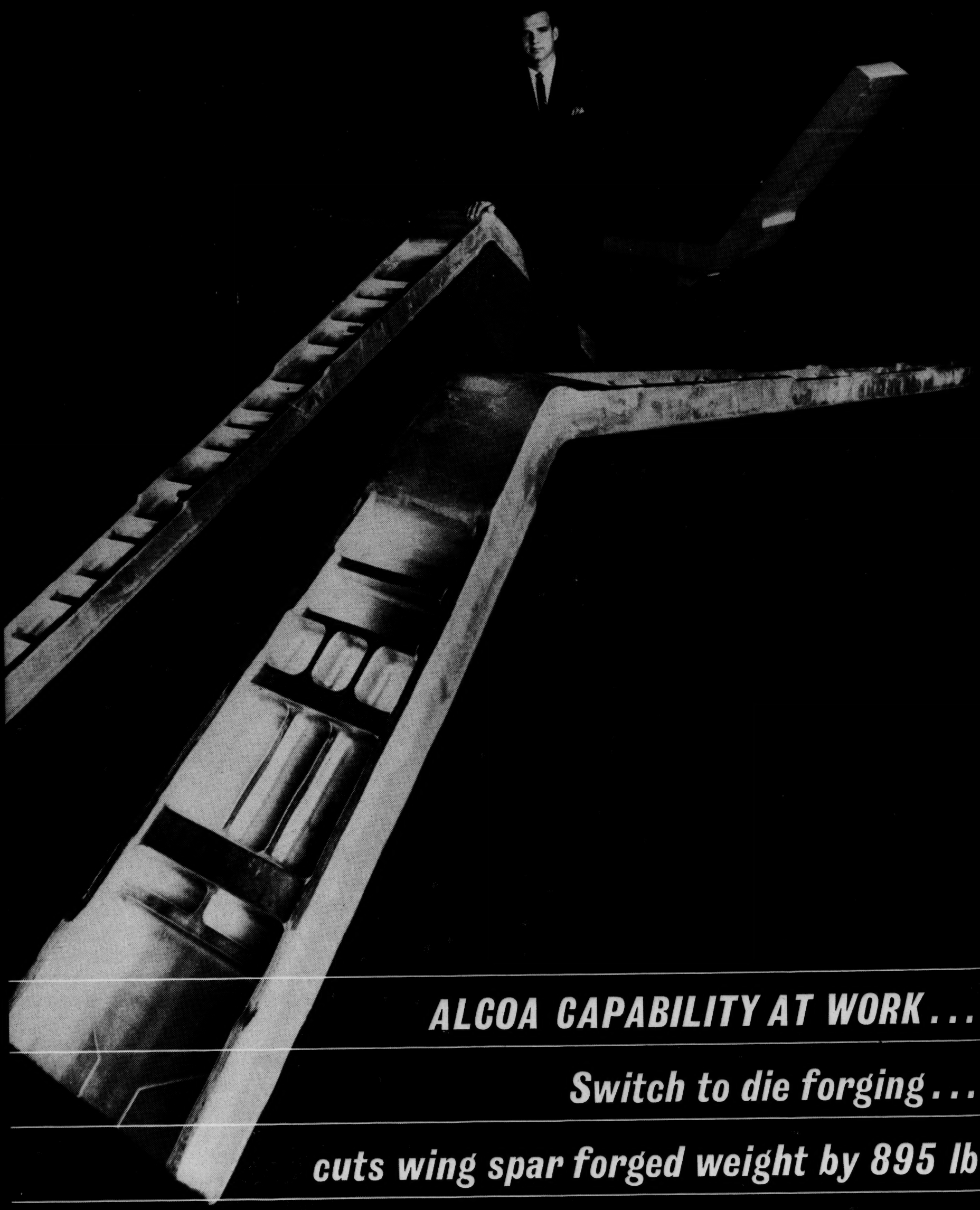
A Division of Fairchild Camera and Instrument Corporation

Photo from the book "HUMMINGBIRDS" by C. H. Greenewalt; © American Museum of Natural History



ALCOA CAPABILITY AT WORK...

Switch to die forging...

cuts wing spar forged weight by 895 lb

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Unretouched photograph shows re-entry of ballistic missile complex. The Bendix plasmatron laboratory is for simulation of re-entry phenomena.

DISCRIMINATION among re-entry objects is the key to an effective and economical defense against ICBM's. Through four years of Army and ARPA sponsored investigations under the direction of the U. S. Army Rocket and Guided Missile Agency, Bendix has been engaged in research projects on the prediction, simulation and verification of the re-entry behavior of ICBM target complexes. These data are prerequisite to successful system synthesis. Senior engineers experienced in this field are invited to join the Bendix team.

Qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

BENDIX SYSTEMS DIVISION
ANN ARBOR, MICHIGAN

THE Bendix CORPORATION

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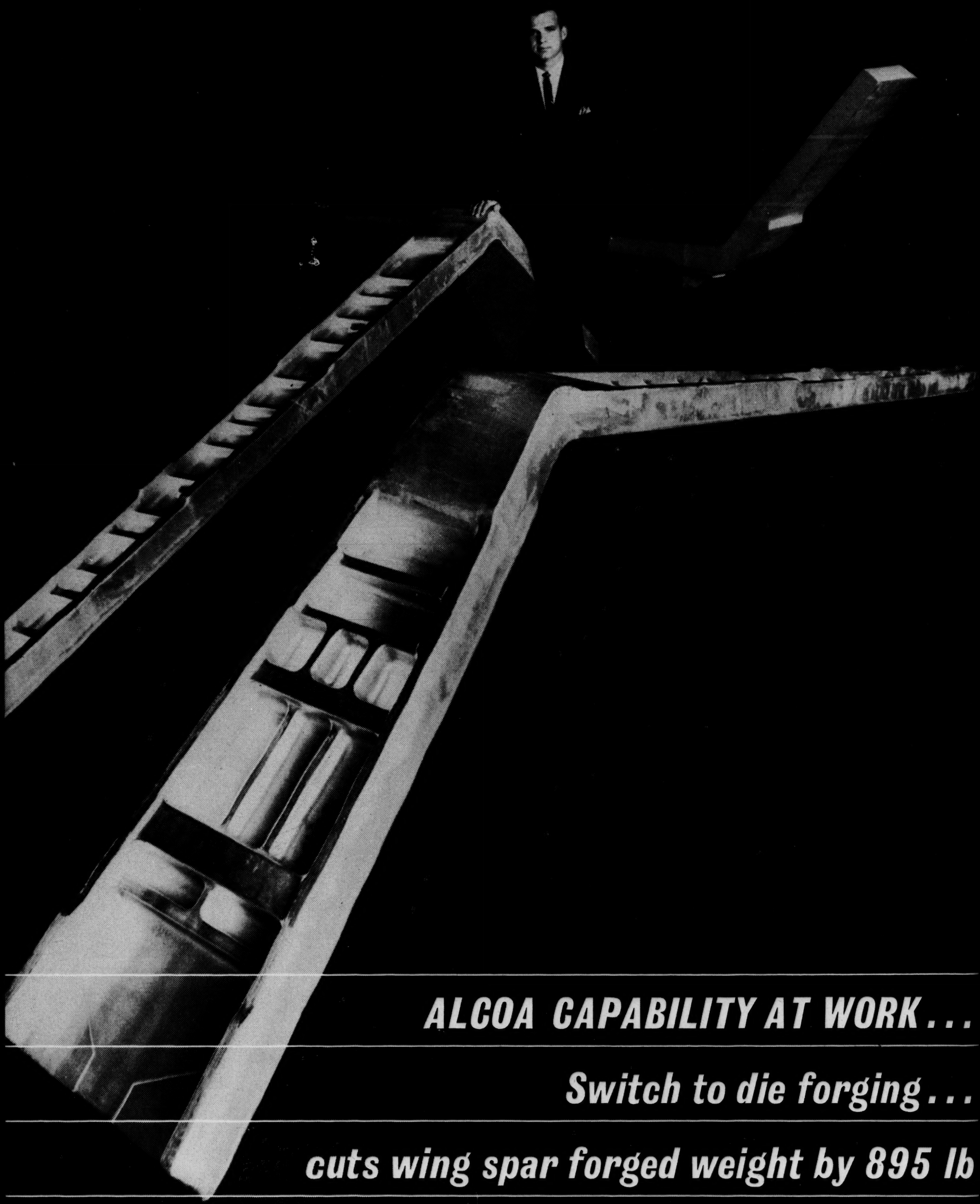

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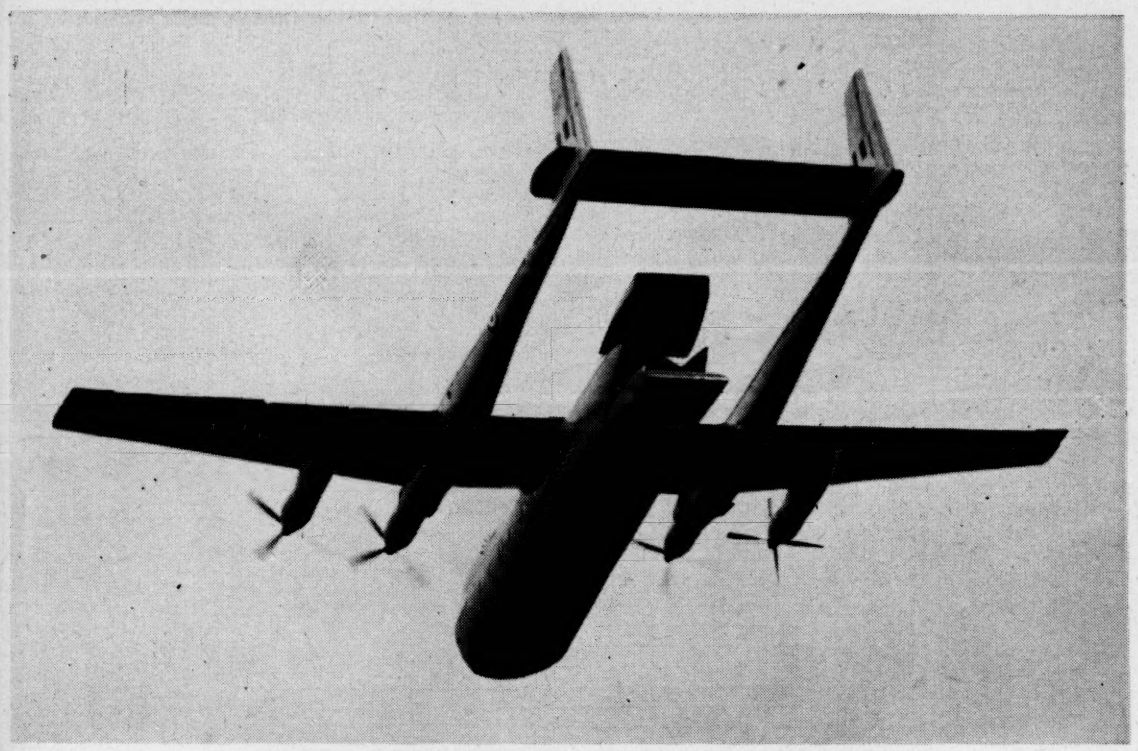


AW 660 Makes Paris Flyby

Armstrong Whitworth AW 660 C.Mk.1 in RAF Transport Command markings stages low-level flyby at Paris Air Show with right outboard turboprop feathered and clamshell doors in open, high-drag position. The AW 660, 56 of which have been ordered by RAF, is military version of the AW 650 Argosy freighter operated by Riddle Airlines. Note navigation radome located on forward belly of the aircraft.

X-15 Pilots Win Harmon Trophy

Winners of the Harmon International Aviator's Trophy are A. Scott Crossfield, Joseph A. Walker and USAF Maj. Robert A. White. Award was in recognition of their accomplishments in flying the rocket-powered X-15 research vehicle during 1960.

Crossfield was the first pilot to surpass Mach 2 in the X-15. He is development engineer and research test pilot for North American Aviation. Walker attained Mach 3.31 on Aug. 4, 1960, in the X-15. He is chief engineering test pilot and a physicist of the National Aeronautics and Space Administration. Maj. White, USAF, on Aug. 12 climbed to 136,500 ft. in the X-15 research vehicle.

The Harmon Trophy, established by the late Col. Clifford B. Harmon, aviator and balloonist, is granted for outstanding international achievements in aeronautics preferably connected with scientific experimentation and research which is of world-wide importance.

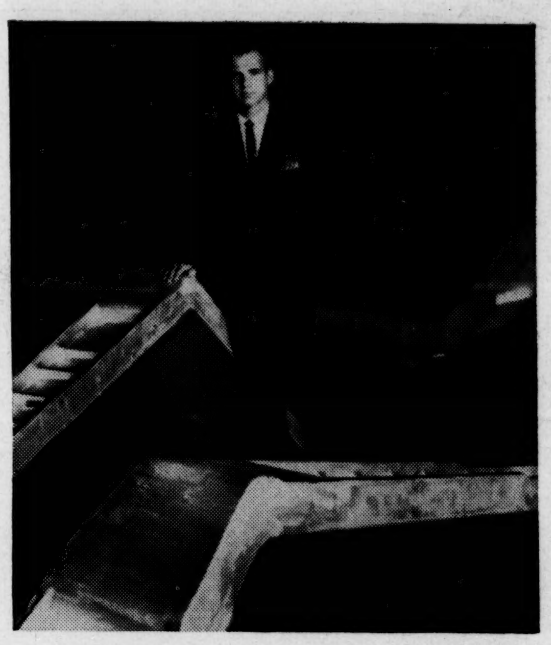
This year marks the first time three pilots were named as joint winners. Presentation of the award to the three winners will be made by President John F. Kennedy in the fall.

Paris Spaceman

Space salesman advertises Trans World Airlines' reservations and reconfirmation service at 24th Paris International Air Show. Gimmick was idea of Emmet Riordan, TWA regional director of public relations-international.

Vanguard 2 VTOL To Begin Hover Tests

Vanguard Air & Marine Corp., Paoli, Pa., will conduct further hover and wind tunnel tests of its Model 2 Omniplane VTOL aircraft under Air Force Systems Command contract. The fan-in-wing vehicle has completed wing modifications and installation of a 825-hp. Lycoming T53 turbine engine. The vehicle derives vertical lift from ducted wing fans and thrust from a rear-mounted propeller.

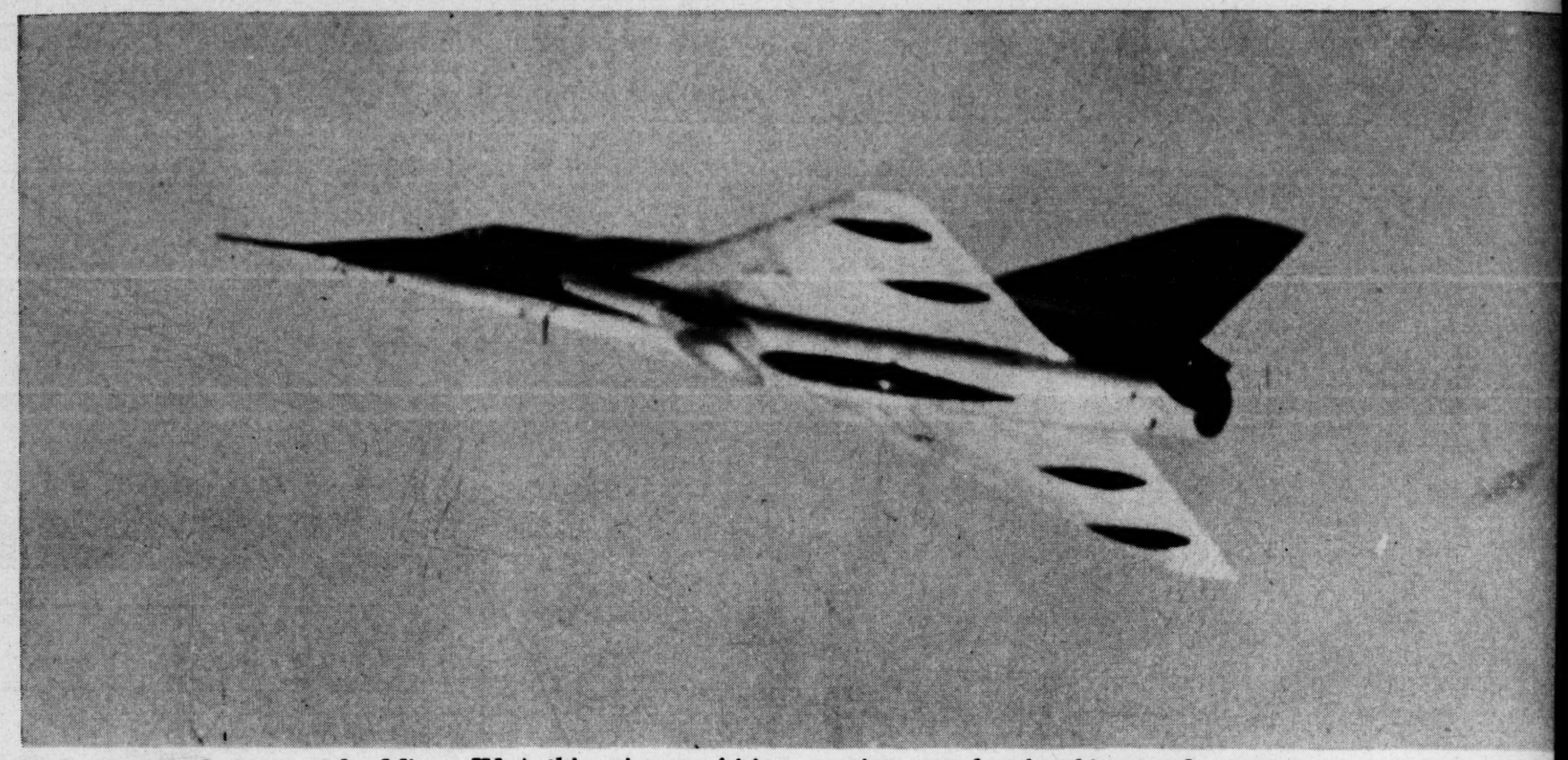


SWITCH TO DIE FORGING... CUTS WING SPAR FORGED WEIGHT BY 895 LB

Originally a hand-forged shape, this 17½-ft wing spar forging weighed 1,600 lb. Alcoa called upon its vast resources of experience and facilities to find a better method of fabrication. Alcoa's capability broke the back of the problem. The solution: die forging. Utilizing advanced techniques considered impossible only a few years ago, Alcoa will forge the part on its 50,000-TON PRESS. The pay-off will be considerable: an estimated 920 hours saved in machining time . . . and weight of the forging cut to 705 lb. This breakthrough by Alcoa will pay an additional dividend to the aircraft designers by opening the door to greater design flexibility.

The die forging of this huge wing spar is a significant example of Alcoa capability at work. Alcoa . . . where the men, the metal and the machines can forge, extrude and cast the solution to your metal problems. How can we help you use this capability? Write: Aluminum Company of America, 1870-T Alcoa Building, Pittsburgh 19, Pa.

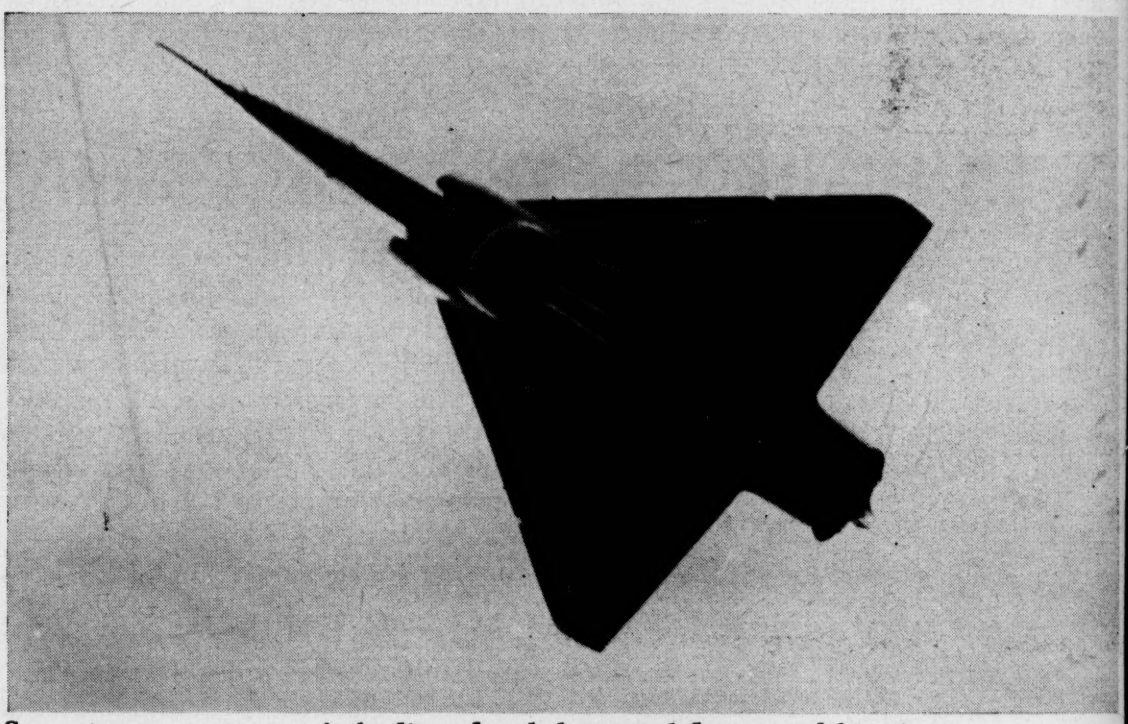
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA



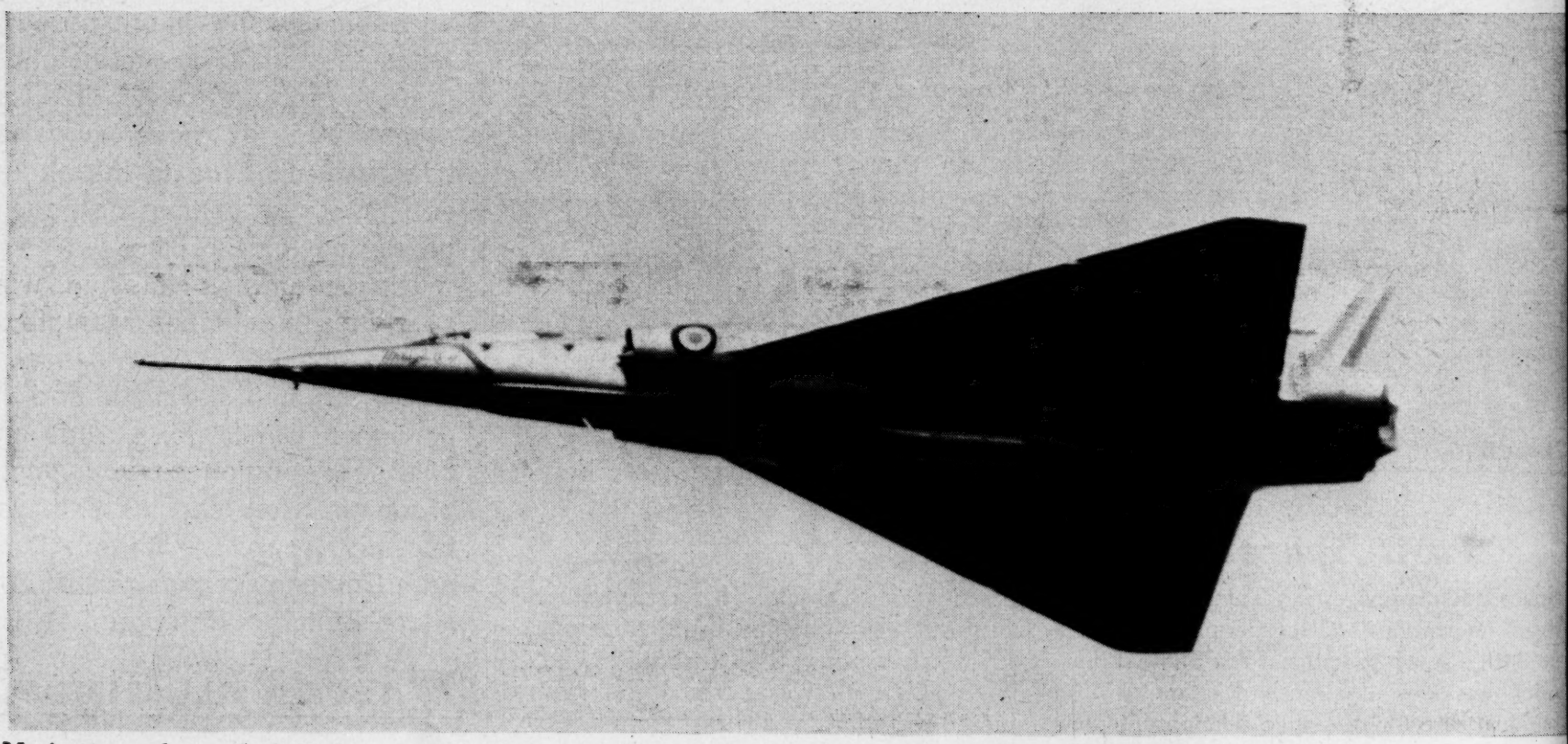
Dark streamlined shapes under Mirage IV A thin wing are fairings covering control surface hinges and actuators.

Weapons, Radar Systems Shown On Mirage IV A

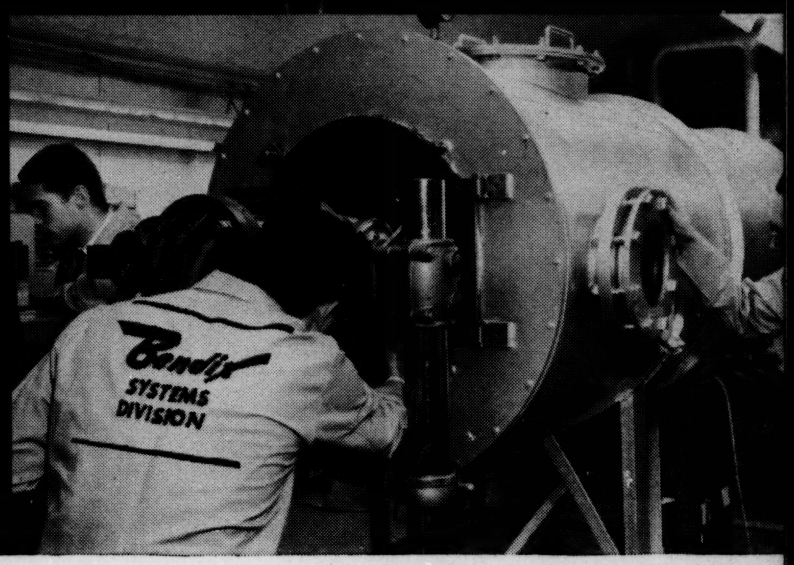
Generale Aeronautique Marcel Dassault's Mirage IV A prototype, shown at this year's Paris Air Show, is planned as main delivery means for French nuclear-weapon strike force. Powered by paired Snecma Atar 9 turbojets rated at 13,225 lb. thrust, the plane has Mach 2 dash performance, and about 2,000-mi. range. Fifty of the aircraft are scheduled to be operational by 1965.



Saw-cut vortex generators in leading edges help control flow over delta wing.



Navigation radome (dark circle), streamlined weapons bay are distinctive features of Mirage IV A. Inlets have variable geometry.



Unretouched photograph shows re-entry of ballistic missile complex. The Bendix plasmatron laboratory is for simulation of re-entry phenomena.

DISCRIMINATION among re-entry objects is the key to an effective and economical defense against ICBM's. Through four years of Army and ARPA sponsored investigations under the direction of the U. S. Army Rocket and Guided Missile Agency, Bendix has been engaged in research projects on the prediction, simulation and verification of the re-entry behavior of ICBM target complexes. These data are prerequisite to successful system synthesis. Senior engineers experienced in this field are invited to join the Bendix team.

Qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

BENDIX SYSTEMS DIVISION
ANN ARBOR, MICHIGAN

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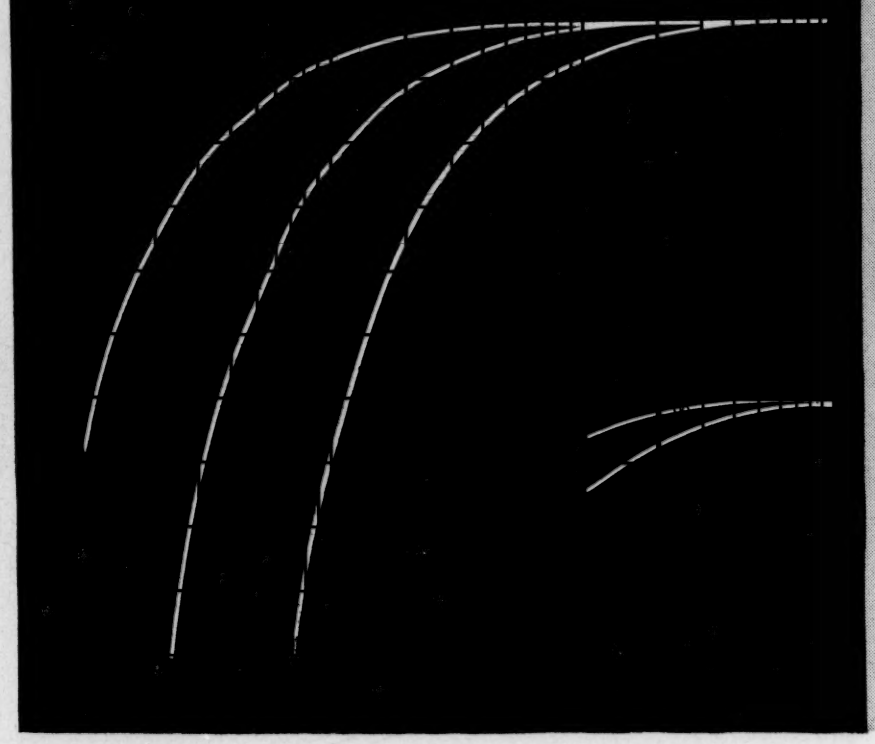
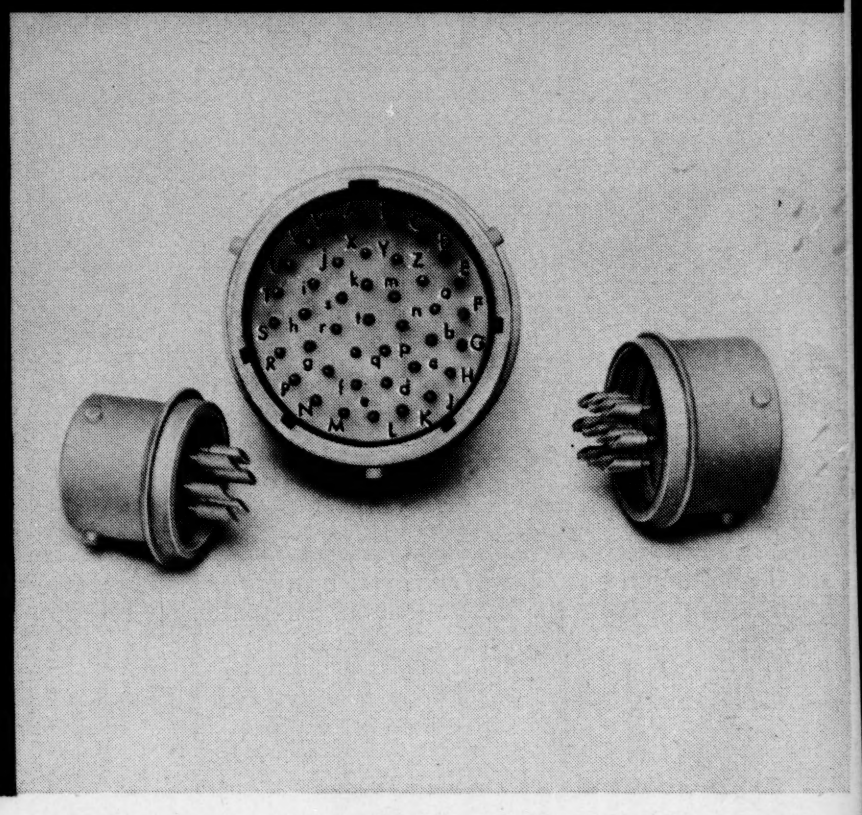
IN HERMETICALLY SEALED CONNECTORS
BUT ONLY
OFFERS PROOF

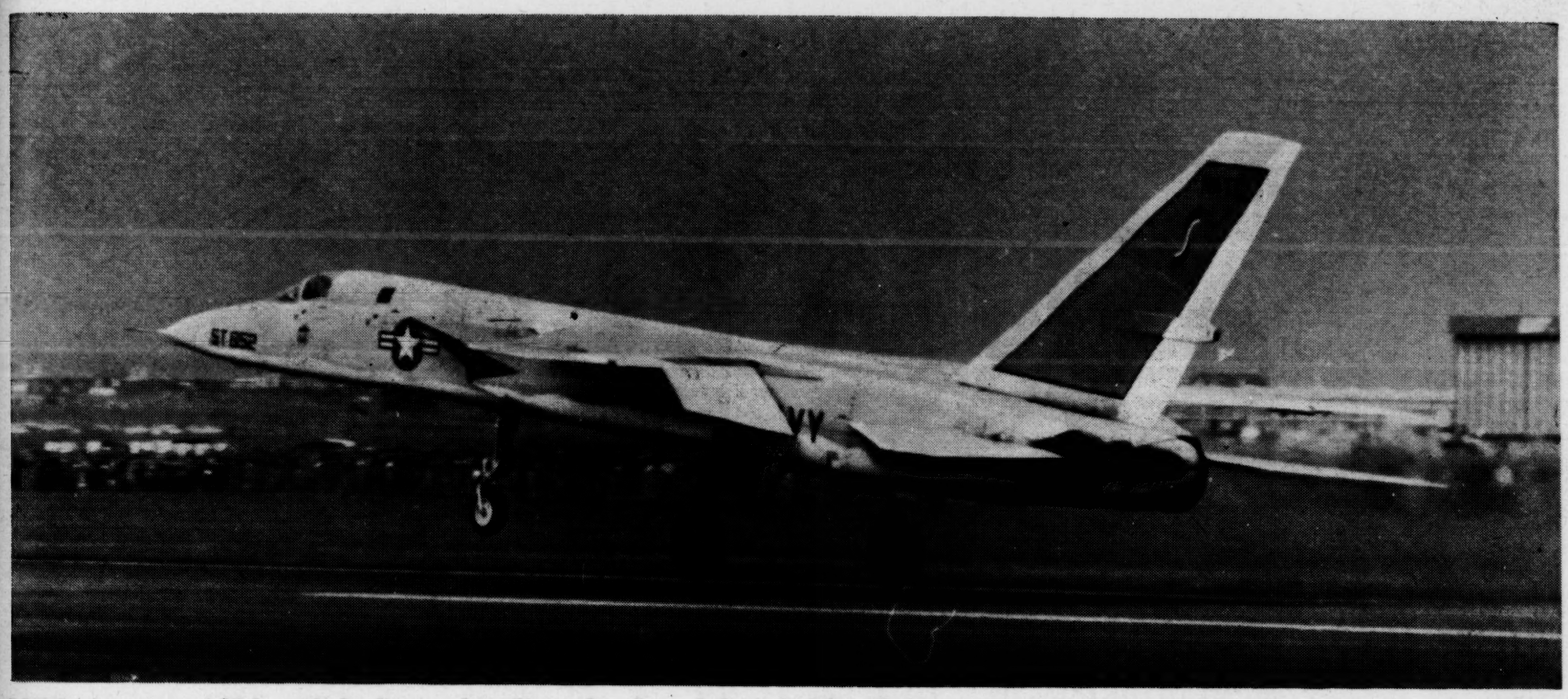




The Cannon KPT Hermetic line is designed to, and far surpasses all requirements of **MIL-C-26482**...has proven statistically reliable in leakage tests 200 times as severe as that required by MIL-C-26482. *Cannon offers you hermetic seals with a reliability coefficient of* .999 *at a confidence level of* 95%. Our rigid manufacturing controls and continued testing guarantee reliability at no added cost—and, in many instances, at lower prices than ordinary hermetic seals. Available for *off-the-shelf delivery* from Cannon stocking points and CAPS Distributors throughout the United States. ● **LEAD-FREE COMPRESSION GLASS** ● **EXCEPTIONALLY LEGIBLE CONTACT IDENTIFICATION FOR FASTER TERMINATING AND CHECKOUT** ● **RELIABILITY ASSURANCE SUBSTANTIALLY REDUCES THE NEED FOR USER'S VERIFICATION TESTING** ● These are only a few of the many reasons why you should consult the world's most experienced manufacturer of electrical connectors for your hermetic sealing needs. For immediate delivery and quotations write, phone, or wire Customer Services Manager, PHOENIX DIVISION, 2801 AIRLANE, PHOENIX, ARIZONA. Phone BRidge 5-4792. Test report and complete KPT Catalog available upon request from:

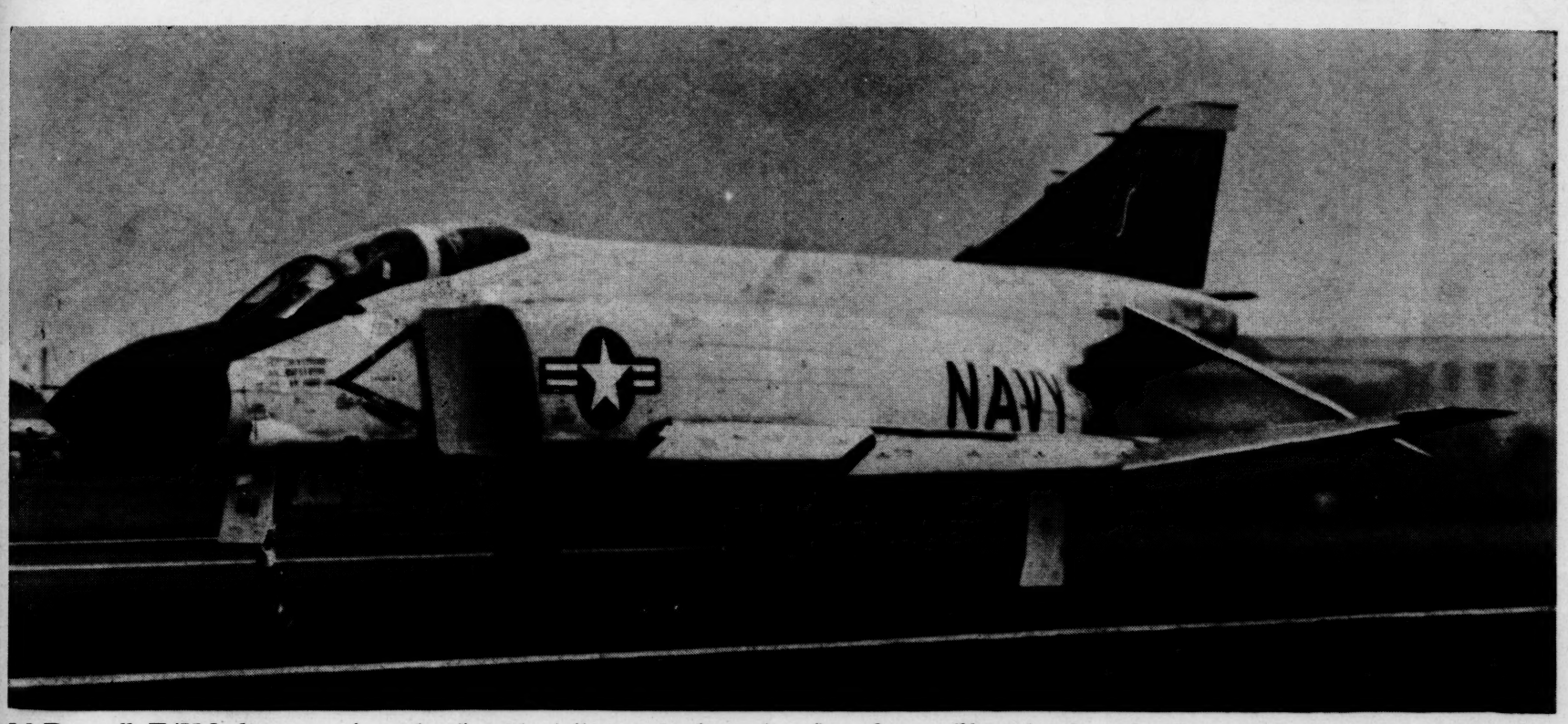
CANNON PLUGS

CANNON ELECTRIC COMPANY, 3208 Humboldt Street, Los Angeles 31, California.

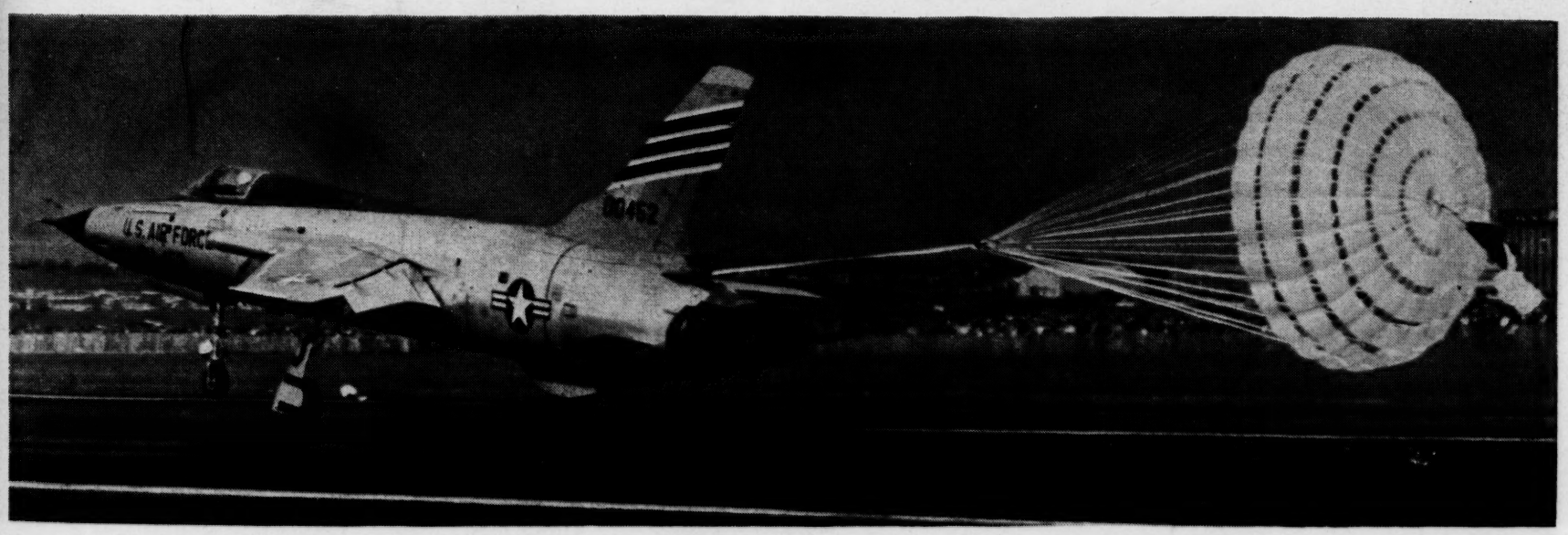


North American A3J-1, with leading and trailing edge flaps deflected, lifts off runway to start demonstration. Plug between exhaust nozzles of twin General Electric J79-GE-2 turbojets is jettisonable, freeing opening for rearward ejection of stores.

U. S. Attack Aircraft Perform at Paris Air Show



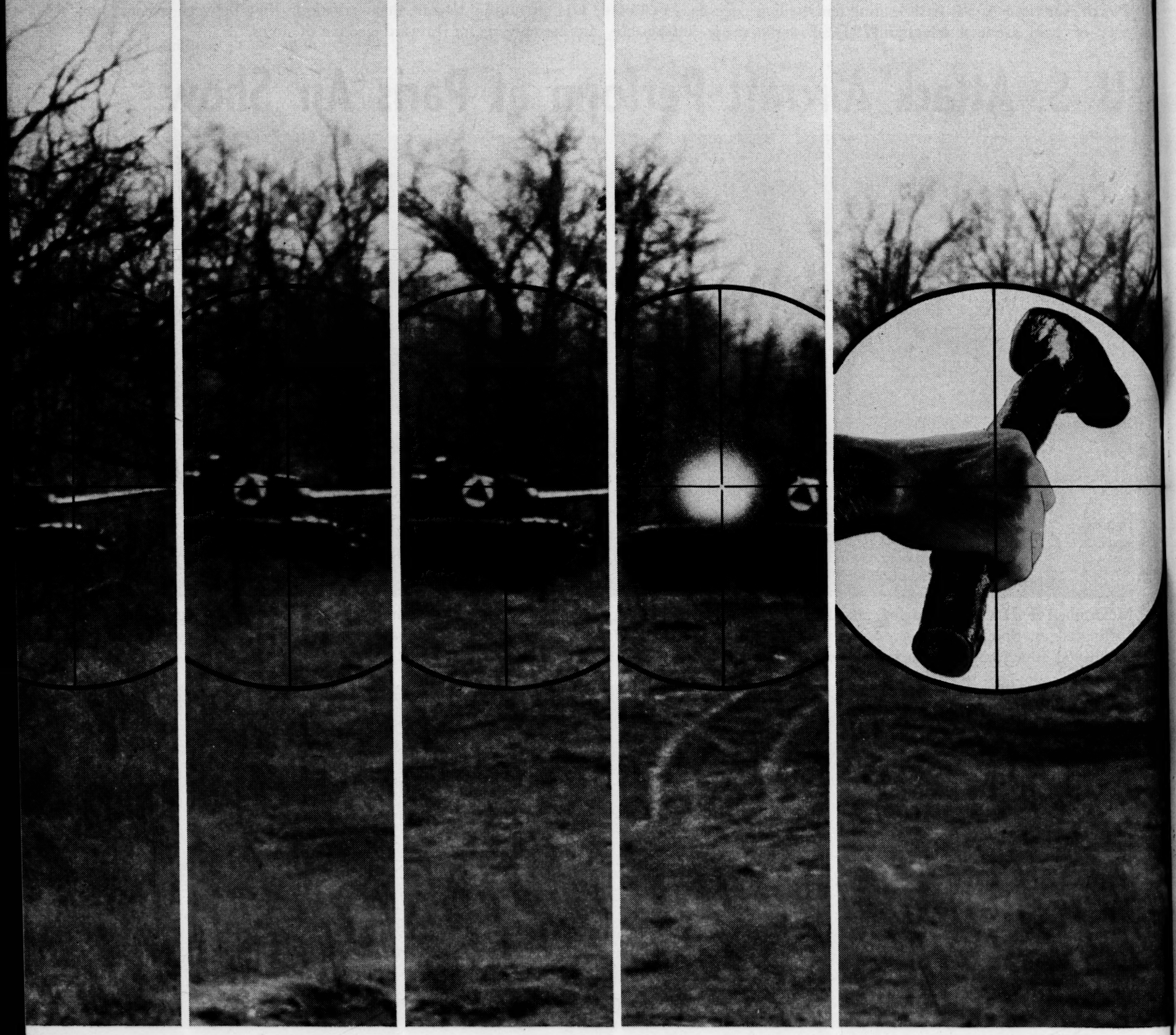
McDonnell F4H-1 lines up for takeoff with full-span leading-edge flaps down. Plane has boundary-layer control on wing leading and trailing edges. Spoilers and ailerons are mounted inboard of dihedral tip. Stabilator slab tail has large anhedral to increase directional stability at supersonic speeds. Inlets for twin GE J79-GE-8 turbojets have variable geometry.



Republic F-105 streams braking chute after touchdown. Petal speed brakes at sides of Pratt & Whitney J75 turbojet are open.

SHILLELAGH

U.S. Army Missile System



The **SHILLELAGH** is being developed for the U.S. Army under the over-all direction of the U.S. Army Ordnance Corps.

The United States Army SHILLELAGH surface-to-surface guided missile–like its Irish namesake–will be simple, reliable... lethal. Against enemy targets–moving or stationary–**SHILLELAGH's** accuracy and firepower will provide the U.S. Army a devastating new weapon that kills with a first-round probability approaching unity ...and at ranges never achieved in antitank warfare. **SHILLELAGH** is now under development at Aeronutronic, prime contractor on this advanced weapon system.

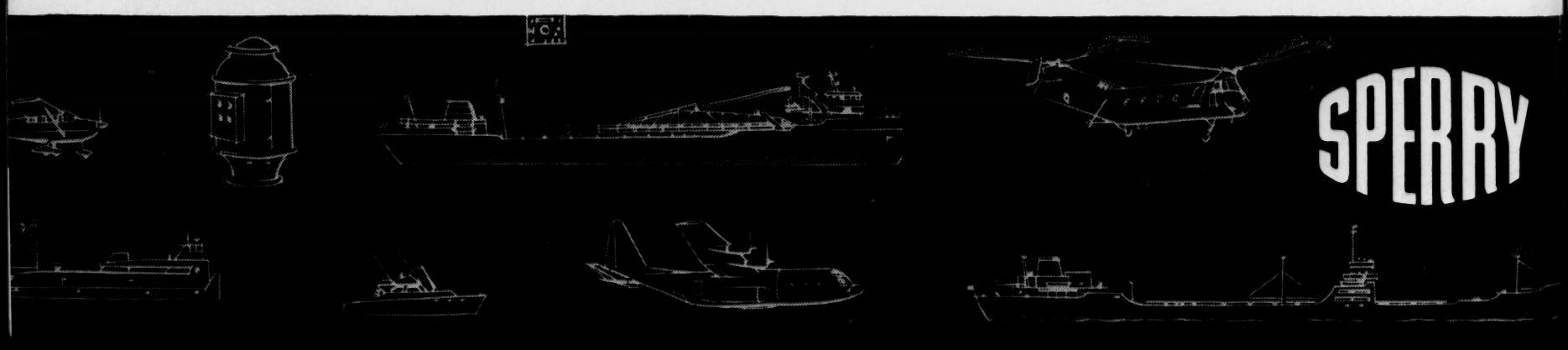
AERONUTRONIC DIVISION *Ford Motor Company,* DEFENSE PRODUCTS GROUP
FORD ROAD. NEWPORT BEACH. CALIFORNIA

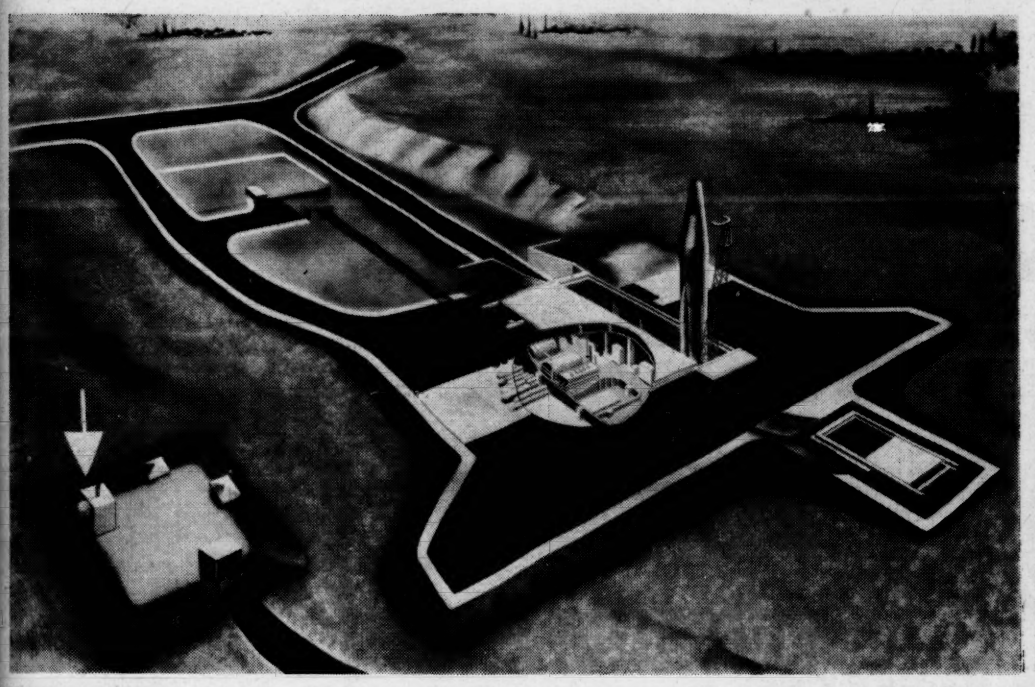
SHILLELAGH is one of many advanced programs currently under development at Aeronutronic's new, million-square-foot Engineering & Research Center at Newport Beach in Southern California.

Write for information about Aeronutronic's capabilities and career opportunities now open for engineers and scientists.

Maximum performance for the military...maximum satisfaction for the industrial customer...these are the goals of Sperry field engineering. A specialized division of personnel expertly trained in application, installation, operation, maintenance and overhaul, it provides on-the-spot engineering support for Sperry's wide-ranging products and systems. There are three integrated support functions: (1) customer training and product orientation; (2) field activity including on-the-job training, application engineering, installation, repair, product improvement; and (3) comprehensive overhaul centers strategically located.

With 50 years of professional experience, Sperry field engineering puts a unique support capability at the service of Sperry customers world wide. General offices: Great Neck, N.Y.





TOUGHENED microwave communications system recently installed at Fairchild AFB., Wash., provides voice and data channels to all outlying Atlas missile launch sites (left). Central microwave station (right), and those at individual launch sites, are housed in underground concrete-steel bunkers except for antennas which are mounted in concrete pillars and enclosed in tough plastic cover.

Rugged Communications Link Atlas Sites

By Philip J. Klass

Atlas ICBM launch sites, dispersed over an 8,000-sq.-mi. area at Fairchild AFB, Wash., have been linked to an underground command control center by means of a toughened microwave communications system designed to withstand bomb-blast overpressures up to 25 psi. (The term "hardened" usually is applied to facilities capable of withstanding overpressures of 100 psi. or more.)

The new microwave installation, built by Collins Radio Co., has automatic fault-sensing and re-routing provisions intended to assure that Strategic Air Command has positive missile launch control despite equipment malfunction, sabotage or blast damage to one or more stations in the system.

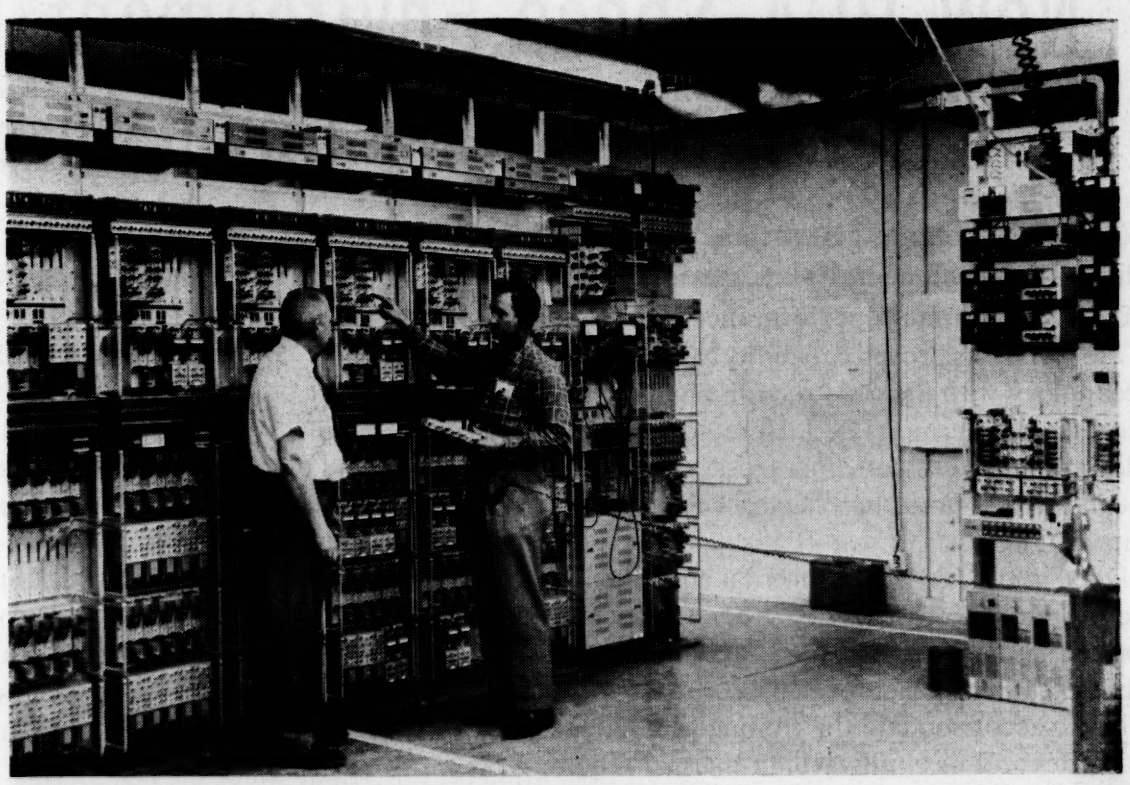
The only elements of the Collins system located above ground are four-foot diameter microwave antenna dishes, mounted in concrete pillars and enclosed by one-inch thick high-strength plastic domes which are transparent to radio waves. The remainder of the equipment—microwave transmitters, receivers, multiplex and switching—is housed in concrete-steel bunkers that are buried 20 feet underground. (See photo at right.)

For communications with underground launch silos at semi-hardened Titan II bases, Air Force plans to use UHF or VHF radio and soon will hold a competition to select contractors for this work. Although UHF/VHF radio lacks the privacy of microwave, it has the advantage that the antenna required is smaller and can more conveniently be retracted underground for protection, when needed. Microwave system antennas could be designed for similar operation, but upon raising them above the ground it would be necessary to align them with moderate precision with distant station antennas.

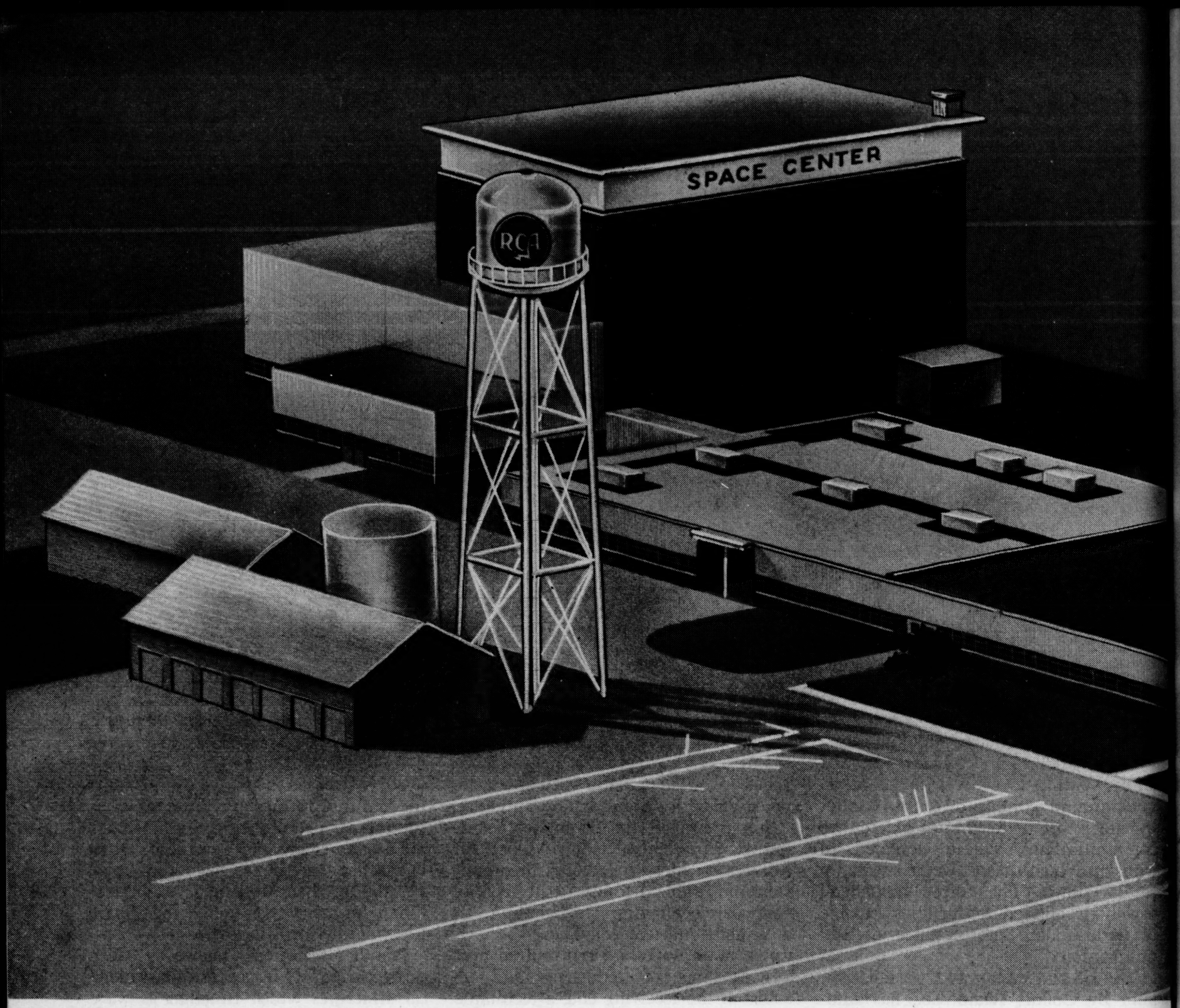
For command and control of deeply buried Minuteman launch silos, Air Force is turning to radio earth-current communications because of its security and relative immunity to jamming. In a system under development by Sylvania, radio waves are transmitted over a wide range of frequencies and decoded at the receiving end, a technique known as "spread spectrum."

The Minuteman launch control system is referred to as "shallow earth currents" because the gridlike antenna is buried only a few feet below the ground. Its radiated waves travel upward to the earth's surface and along the channel formed by the earth as a conductive medium and the atmosphere as a non-conducting medium, then downward to the receiving antenna. Feasibility of the technique was established in tests conducted by Space Electronics Corp. in 1959.

Another technique, known as "deep earth currents," makes use of geological structures which function as wave guides for RF energy. One is a dry layer of sedimentary rock bounded by



MICROWAVE EQUIPMENT, built and installed by Collins Radio, employs modular plug-in construction to facilitate maintenance and repair, and to permit future expansion if needed.



New RCA Space Environment Facility Brings Outer Space Down to Earth...

...Will pretest coming generations of U.S. space vehicles and satellites at environmental extremes assuring reliable long life operation and optimum performance.

RCA expands its proved capability to meet the challenges of space-age technology with the construction of an advanced space environment center at Princeton, N. J. Here, today's *and* tomorrow's space vehicles and satellites can undergo a new degree of intensive and thorough testing prior to "launch" to achieve greater reliability in space.

Included in the new environmental equipment and facilities being built and installed at the RCA Space Center are the following advanced testing devices:

Vacuum-Thermal Chamber—measuring 28 feet in diameter and 25 feet high to accommodate the coming generations of space vehicles and satellites and meet all vacuum-thermal requirements.

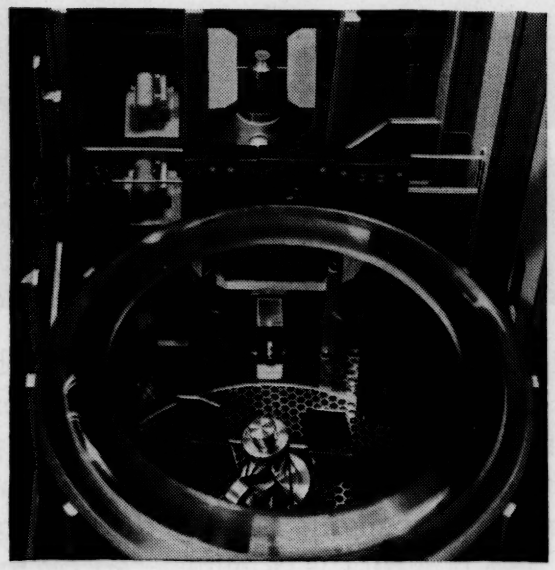
Vibration System—provides 28,000 pounds peak force for sinusoidal, and 28,000-pound rms force for random motion testing.

Temperature-Humidity Chamber—so versatile it can create virtually any thermal-humidity condition desired. Temperatures may be varied from −85° F to 250° F; humidity from nil to maximum

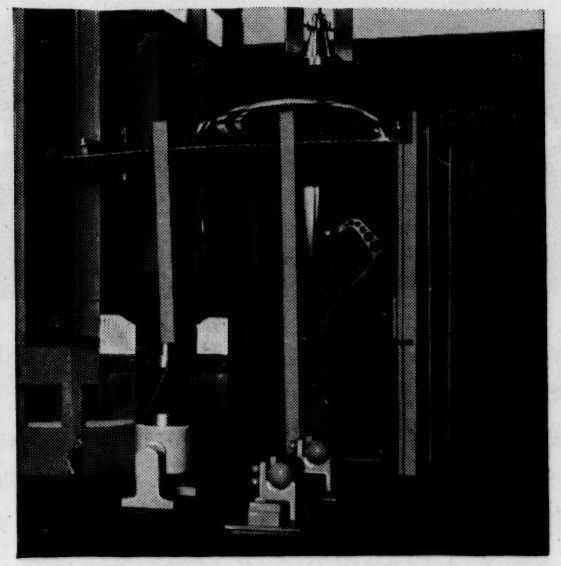
Rotary Accelerator—subjects subsystems of space vehicles and satellites to forces as high as 2500 g lbs.

The entire RCA Space Center, which contributed to the success of projects such as SCORE, TIROS I, TIROS II and ECHO I, continues to be dedicated to the conception, development and production of earth satellites, space vehicles and ground support and information handling equipment. For additional information about RCA engineering talents and proved capabilities, contact the Manager, Marketing, RCA Space Center, Box 800, Princeton, N. J. And, for complete description of the new environmental facilities, write for your copy of the brochure "RCA Space Environment Center."

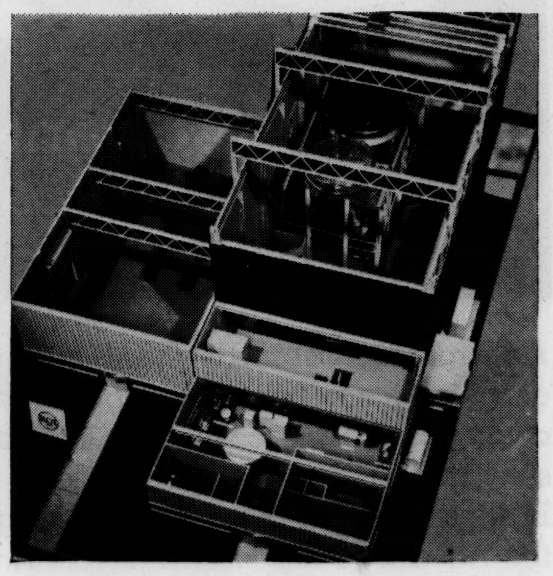
If you are interested in participating in the challenging opportunities that exist at the RCA Space Center, contact the Employment Manager, Astro-Electronics Division, Defense Electronic Products, Princeton, N. J. All qualified applicants are considered regardless of race, creed, color or national origin.



New advanced Vacuum-Thermal facility shown in model has pumping system that can reduce pressure to 5 x 10^{-6} mm Hg within 24 hours with a 3500-pound payload in the enclosure.



New Vibration System will include 28,000-pound exciter driven by an amplifier capable of delivering 140 KW over a frequency range of 25 to 10,000 cps.



All existing environmental equipment will be housed here and a new high-bay assembly area provides facilities for assembly of an increased number of space systems.

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ESAR

electronically-steerable array radar

An experimental model ESAR radar which demonstrates the fundamental aspects of electronically-steerable array radar is now undergoing test at Bendix Radio. The successful culmination of this experimental effort could provide the basis for a new technology leading to the development of multiple function, electronically-steerable array radars capable of searching, tracking, deep space communications and command control. ESAR is part of Project DEFENDER, the program of advanced research in ballistic missile defense directed by the Advanced Research Projects Agency, Department of Defense. The ESAR contract is administered by the Rome Air Development Center of the U.S. Air Force. Organizations working on advanced space concepts are invited to contact Bendix Radio for details, and to see ESAR in operation.

Bendix Radio Division

GOVERNMENT PRODUCTS • BALTIMORE 4, MARYLAND

THE Bendix CORPORATION

wet conductive layers. Another, still deeper, is the crystalline granite and basaltic rock structure.

At the recent Global Communications Symposium in Chicago, Raytheon's Gregory J. Harmon reported that company tests, under Air Force sponsorship, had demonstrated radio wave propagation through rock strata over distances of up to 18 mi. at radio frequencies of about 200 kc., using radiated power of 100 watts. Harmon said that Raytheon hopes to increase range to 50-100 mi. during the coming year at frequencies of 15 kc. to 40 kc. The deep strata radio wave propagation retains the signals within the earth, providing great privacy and freedom from external noise, Harmon reported.

The Collins system installed recently at Fairchild AFB provides several voice channels to and between each Atlas launch site, as well as command and control function circuits which keep the control center advised of the ready status of each site.

The Atlas launch sites are located around the periphery of an elliptical shaped area which measures approximately 100 x 80 mi. with an underground microwave central station situated roughly at the center. To provide maximum flexibility and reliability, the individual launch site microwave stations are connected into three communication loops:

- **East loop,** containing approximately half of the individual launch site stations.
- **West loop,** containing the remainder.
- **Interconnect loop,** which links all of the stations.

Under normal operating conditions, the Collins system provides two radio frequency paths from the central control center to a relay station, located at one of the two intersections of the east and west loops. The relay station routes one path to the east loop and the other to the west loop. Each subsequent microwave station in the individual loops, in addition to handling traffic in and out of its own launch site, also serves as a relay to the next site in its loop.

If one or both of the RF paths from the central station should be disrupted, the circuits automatically are switched to another antenna, facing in the opposite direction, which instantly establishes communications by means of a second relay station located at the other intersection of the east and the west loops.

If a circuit disruption should occur somewhere along the east or west loops, preventing an individual launch site station from acting as an intermediate relay for its adjoining station, then automatic switchover occurs to route traffic in both directions around the "broken" loop using both of the main relay stations.

The interconnect loop, consisting of all of the site stations in both east and west loops, provides primary and alternate circuits between both loops and makes available a small number of highly reliable circuits between all points of the system, according to Collins Radio.

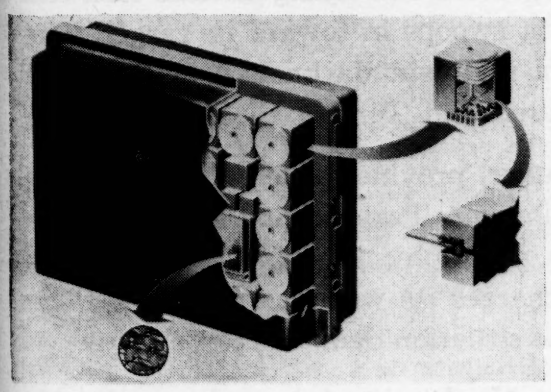
If there should be an interruption of normal circuit routing, automatic sensing circuits initiate the required switching operations as well as actuating visual and audible fault alarms at the control center. Re-routing switching occurs in so brief an interval (0.05 seconds), that users might not otherwise know that an outage has occurred.

The present system has the capability of providing 480 voice channels (3-kc. bandwidth), although this number is not now in operation. If needed, the system can be expanded to provide up to 600 voice channels, Collins says. Multiple channels are provided by frequency division multiplexing.

Dual frequency diversity is employed for each of the RF paths with signal combining to provide superior performance and resistance to fading than can be obtained using only a single operating frequency.

The microwave transmitters and receivers are stackable which permits the use of a common wave guide and antenna system without using circulators, according to Walter Wiseman of the company's Texas Division, which produced the system. Equipment racks in the underground bunkers are installed on specially designed shock mounts to protect them from bomb-blast shock transmitted through the earth.

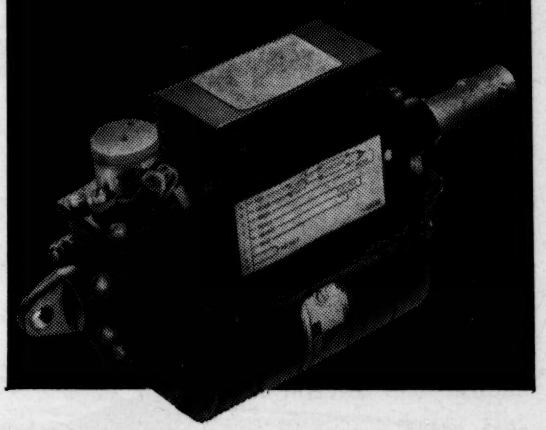
Each of the microwave stations in the system is equipped with a float-charged battery system which can provide power for eight hours of operation if primary power supply to the station should be disrupted.



Molectronic Computer

Molectronic digital computer, under development by Westinghouse Electric's Air Arm Division, is expected to weigh less than 15 lb. and occupy less than ⅓ cu. ft., the company says. New computer is outgrowth of company program in molecular electronics under Air Force sponsorship. Texas Instruments also is developing molectronic computer, under USAF sponsorship.

COMPACT AiResearch 60 cycle Actuators *for ground use . . .*



Inexpensive, lightweight 60 cycle motor driven actuators with integral magnetic brakes* are now being manufactured by AiResearch for ground radar, ground support and shipboard use.

Unequalled in 60 cycle performance, these extremely compact, lightweight actuators range from fractional hp motor size up to any desired hp in single phase, two phase and three phase design for a wide variety of applications.

The above-pictured actuator is used in a ground radar system. It is driven by a single phase 60 cycle ac fractional hp electric motor and can be furnished with a feedback potentiometer for use in servo applications. The entire unit weighs only 2½ lb. and is rated at 200 lb. operating load.

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Your inquiries are invited.

* *patented 60 cycle operated magnetic brake*

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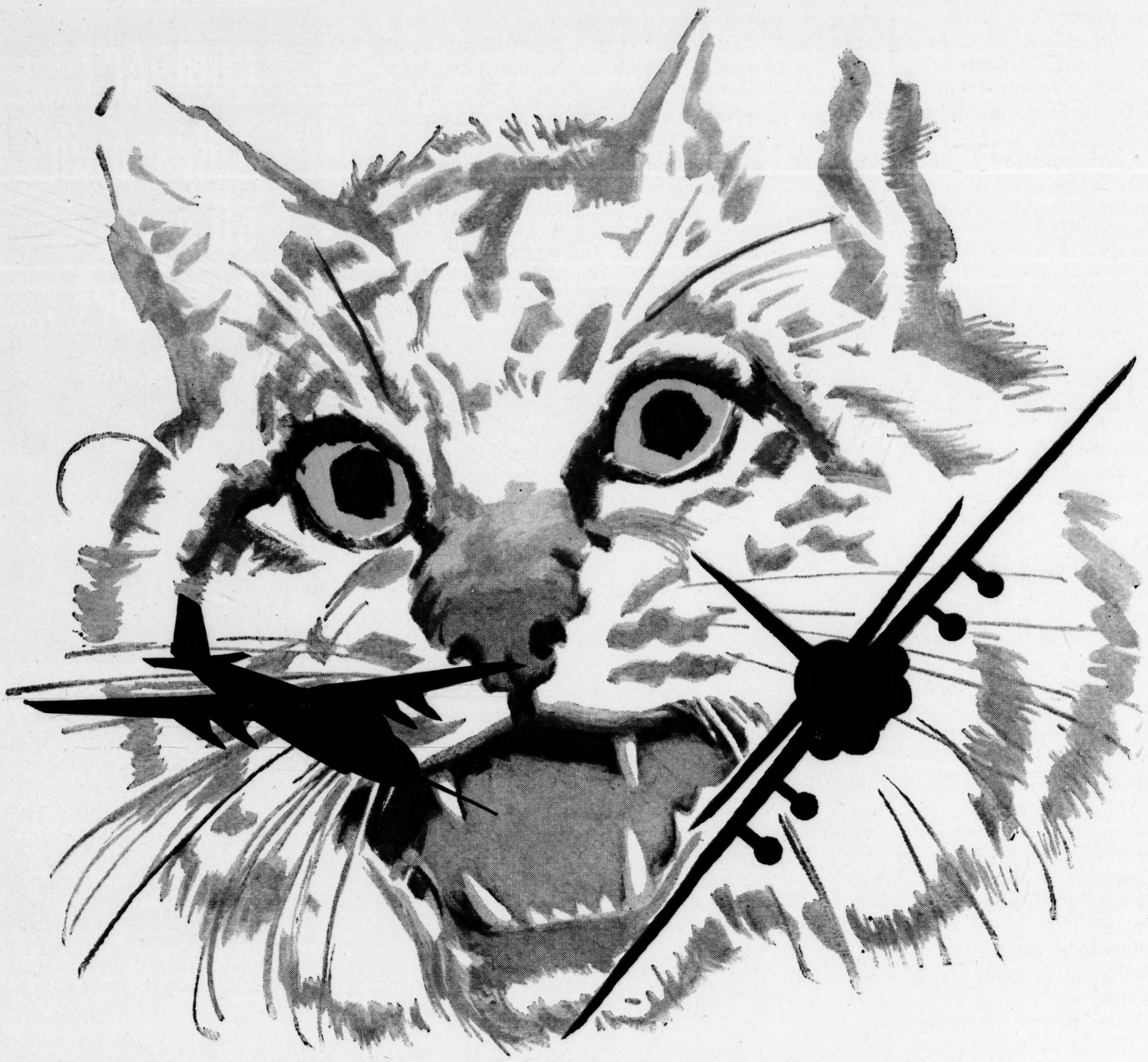


"Cat's Eyes" for the Navy's Intruder

The Grumman carrier-based A2F-1 Intruder is an elusive, low-flying aircraft that can follow a course around hills and other hazards as it swoops in toward its target. The pilot "sees" his course and target clearly even in midnight darkness . . . or in spite of severe weather conditions . . . by Norden's Search and Terrain Clearance Radar.

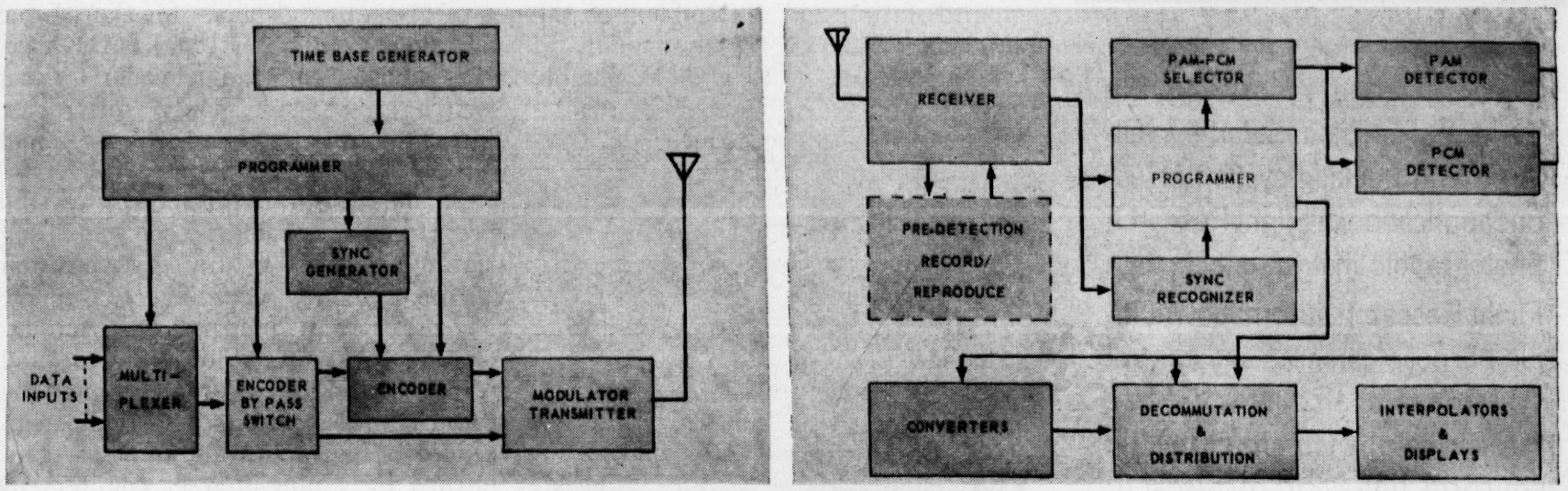
This system, serving as "cat's eyes" for the Intruder, provides an electronic display of information supplied by advanced sensory equipment. Two viewing screens in the cockpit enable the pilot to determine targets and geographical features. The aircraft automatically pursues the desired approach, discharges its weapons and leaves the target area. The pilot may easily alter course if the situation demands it.

This is just one of several important programs at Norden involving advanced television and radar systems. It is another Norden contribution in strengthening our nation's defense by EXTENDING MAN'S CAPABILITIES.

NORDEN

division of UNITED AIRCRAFT CORPORATION

NORWALK, CONNECTICUT



HYBRID TELEMETRY SYSTEM for airborne and missile applications being developed by Aeronutronic Division of Ford Motor Co. under tri-service program can transmit analog data by pulse amplitude modulation (PAM), digital data by pulse code modulation (PCM) or data of widely different accuracies or resolution by a mix of the two techniques, called PACM. The radio frequency carrier is frequency modulated in each case. Block diagram of aerospace PACM telemetry (left) differs from PCM/FM system by addition of encoder by-pass switch which routes PAM data directly to the modulator. Single ground station (right) can accommodate PAM/FM, PCM/FM or PACM/FM.

Services to Investigate Hybrid Telemetry

By Barry Miller

Newport Beach, Calif.—Armed services are planning to test a hybrid telemetry which combines in a single system the capabilities for high accuracy and high data rates inherent to pulse code modulation (PCM) and pulse amplitude modulation (PAM) systems, respectively.

Known as PACM/FM (AW Apr. 4, 1960, p. 115), the hybrid system is so designed that analog and digital inputs in the form of PAM or PCM may be interlaced on the same frequency modulated RF carrier. If extreme accuracies in data transmission (0.5% or less) are desired the system can be made to operate predominantly or entirely with PCM; if medium accuracy is acceptable, the system can use PAM with its advantage of high data rates.

The first PACM telemetry system currently is being built here by engineers of the Aeronutronic Division of Ford Motor Co. This organization won a recent industry competition, sponsored by the Air Force's Aeronautical Systems Division (formerly Wright Air Development Division) to build and demonstrate a PACM/FM ground station and sample airborne PACM equipment.

Aeronutronic's contract, valued at roughly $500,000, is a continuation of a tri-service investigation of future aircraft and missile telemetry needs and the PACM/FM concept is an outgrowth of a previous company contract from the Army's Signal Corps as part of the tri-service studies (AW Apr. 4, 1960, p. 115).

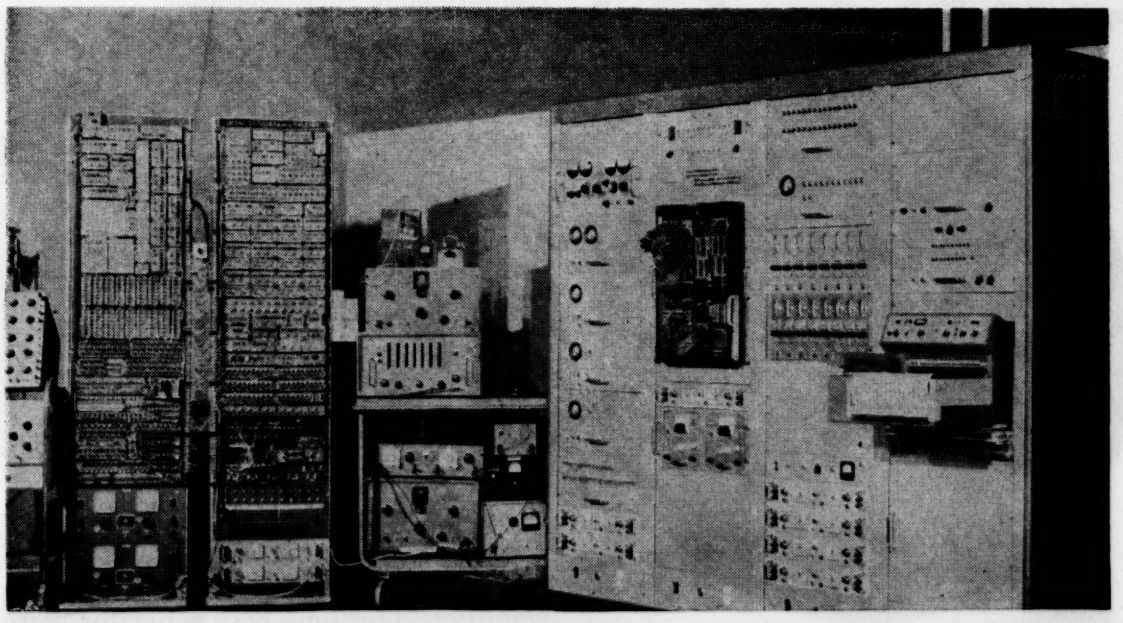
After a survey of telemetry users and a projection of expected telemetry requirements, Aeronutronic engineers conclude that the PACM/FM system will satisfy 90% of instrumentation requirements for the next 10 years. It has the advantage of flexibility provided by the dual modulation scheme which makes it possible to satisfy a wide range of future telemetry needs.

As an example of its use, if PACM/FM were employed in a lunar probe vehicle, the company says, it would operate in different modes depending on its flight profile. During boost and until injection into orbit, all vibration and instrumentation data, as well as a possible voice channel output could be telemetered by PACM/FM. When the vehicle is in earth orbit, and vibration data is no longer returned to earth, then the proportion of PAM to PCM modulation could be increased. At lunar distances the modulation ratios can be changed to raise the proportion of PCM for slow-speed, high-accuracy data transmission.

Tests of the system will be conducted at a national missile test range, still to be selected, sometime after the equipment is delivered to the Air Force next year.

An important aspect of Aeronutronic's Air Force contract will be to develop general procurement specifications for the PACM/FM gear which eventually could become a military and industrial standard for general purpose use. These specifications would give every manufacturer of time division telemetry a chance to compete for PACM/FM hardware ordered by military, industrial or space agencies, Aeronutronic points out.

Aeronutronic, apparently confident that the armed services would proceed with the development of a system based on its recommendations in its earlier Signal Corps contract, began developing a PACM/FM model over a year



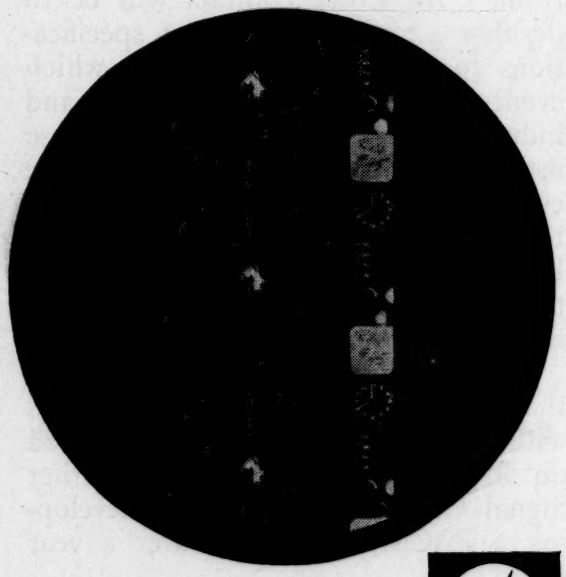
HYBRID telemetry (PACM/FM) ground station and simulation of airborne equipment (in the two racks at left). On basis of tri-service-supported survey of telemetry user requirements (AW Apr. 4, 1960, p. 115), Aeronutronic engineers say that PACM/FM could satisfy 90% of telemetry requirements for next 10 years.

Recording and measuring the performance of a radar surveillance and tracking system is just one application of Flight Research photographic instruments.

Flight Research automatic, multiple purpose cameras and control systems are also now in use measuring phenomena from the courting behavior of birds to booster separations; from underwater weapon performance to flights toward the sun.

Our technical staffs in Virginia and California will be pleased to assist in applying our electronic-photo-optical techniques toward the solution of your problems in data acquisition and analysis.

Wm. J. Lundt, III
President



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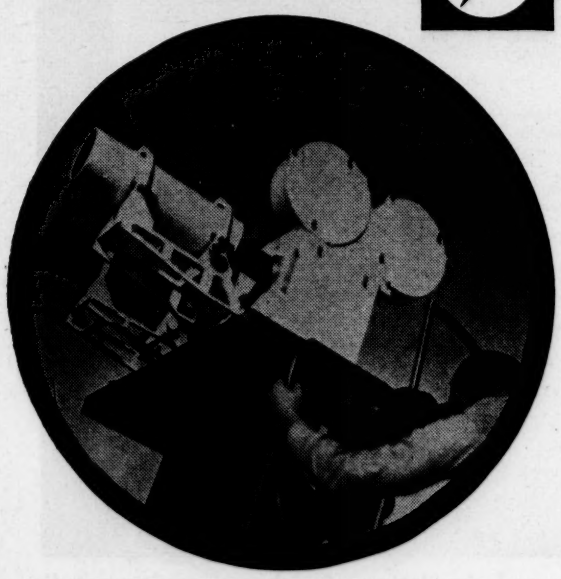


FLIGHT RESEARCH, INC.
P.O. Box 1-F, Richmond, Virginia

ago. It is now well along with the ground station and a simulator of the airborne portion of the equipment.

Besides its flexibility, other desirable features of the hybrid system, according to company engineers, are:

- **Minimum susceptibility** to interference.
- **Optimum use of RF spectrum.**
- **Minimum transmitter power** and equipment weight.

Specifications for the Aeronutronic hybrid telemetry include:

- **Modulation technique**—PAM, PCM or combination of the two interlaced on a single carrier.
- **Bit rate**—Selectable from 8,000 to 800,000 bits/sec. in accordance with IRIG (Inter-range Instrumentation Group) telemetry standards.
- **Accuracy**—Capable of achieving 0.01% with capability of over-all system error of 0.1%.
- **Bandwidth**—While a function of selected bit rate, the maximum receiver RF bandwidth is 1 mc. at 800,000 bits/sec.
- **Word and frame structure**—Frame lengths of 2,048 bits and PCM words from 6 to 64 bits are provided.
- **Frame synchronization** – Preselected frame synchronization words up to 33 bits long are identifiable.
- **Word structure**—In PAM mode, 50 and 100% duty cycle sample pulses; in PCM mode, NRZ (non-return-to-zero) pulse format; in the PACM mode, 100% duty cycle, PAM pulse length an integral multiple of the PCM bit period while PCM encoded analog data words are 6-15 bits with last bit parity and digital data words are 6 to 64 bits.

In block diagram form (shown in diagram on p. 75), the airborne portion of PACM/FM system differs from a PCM/FM system by the addition of an encoder bypass switch which routes PAM data directly to the transmitter modulator. In addition, the programmer which is the heart of the airborne equipment is more complex.

The encoder bypass switch consists of two gates (an encoder and a modulator gate) and a switch (flip flop), according to Aeronutronic. Outputs from the multiplexer are sampled to prevent errors in dynamic signals and held by the sample and hold device. The latter's output is applied to the two gates which are controlled by the flip flop. The flip flop closes the modulator gate for PAM samples, the encoder gate for PCM samples. The programmer provides set and reset inputs for the flip flop as well as the sampling pulse.

All of the timing and logical operations producing the final pulse wavetrain format are controlled by the programmer. The time base generator controls the programmer's rate of operation. Among the signals generated by the programmer are stepping pulses for the multiplexer and submultiplexer, sample command pulses for the sample and hold circuit, PAM and PCM selection pulses for the encoder bypass switch, reset and parity interrogate pulses and sync word "zeros" and "ones" for the encoder.

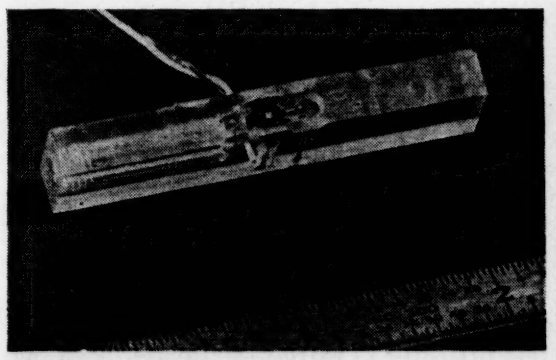
An 11-stage binary counter gives the programmer capability of generating timing signals at any bit position within a frame, according to a report on the system prepared by Aeronutronic. It is resettable at any desired count within 2,048, representing the total number of bits per frame employed in an application and is accomplished by a plug-in reset counter circuit.

The system's dual ground station can receive, decommutate, record and display PAM/FM, PCM/FM and PACM/FM at all of the standard bit rates selected by switch and plug-in.

Incoming RF signals are passed through an RF bandpass filter to protect the multiple conversion, superhet receiver front end from overload due to strong adjacent channel interference.

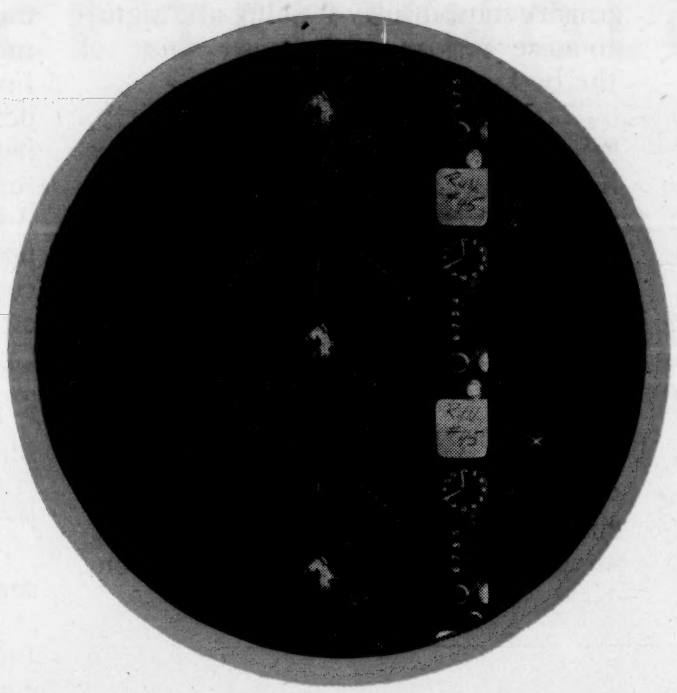
The programmer in the ground station performs counting and logical operations needed to separate PAM and PCM words within the frame, sync the detectors, the decommutator and perform parity check.

Several years ago, when the services chose Aeronutronic to conduct a study of telemetry needs over the next decade or more, one reason for selecting this company was that it was not a telemetry equipment manufacturer, hence did not have a previous commitment to one form or another telemetry system. Now, however, Aeronutronic indicates that should the services decide to go ahead with PACM/FM procurement it will be one of the companies competing for the business.



Moonlight Detector

Moonlight detector, for determining orientation of a satellite relative to the moon, has sensitivity 10 times that of a conventional silicon solar cell, according to International Business Machines Corp. which developed device for NASA. Conventional semiconductor junction is replaced by silicon crystal covered with a transparent electrolytic (sulphuric acid). Loss of light energy by absorption is greatly reduced because light penetrates liquid more easily than semiconductor material.



Giannini Scientific Corporation is comprised of a group of independently managed companies pursuing various scientific disciplines. Advanced research, financial management and long range planning are carried out at the parent company. Areas of activity include: photo instrumentation, high temperature generators, electrical space propulsion and systems, microwave radiometry, high speed dynamic balancing and photo electric switching.

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▶**Winter Study Group Report Available**—An abstract of the Air Force's Winter Study Group Report, analyzing existing and planned USAF command and control systems, is available to companies having an established "need to know" and access to "Confidential" material. Such companies may request copies from Deputy for Advanced Planning, Electronic Systems Division, Hanscom Field, Bedford, Mass.

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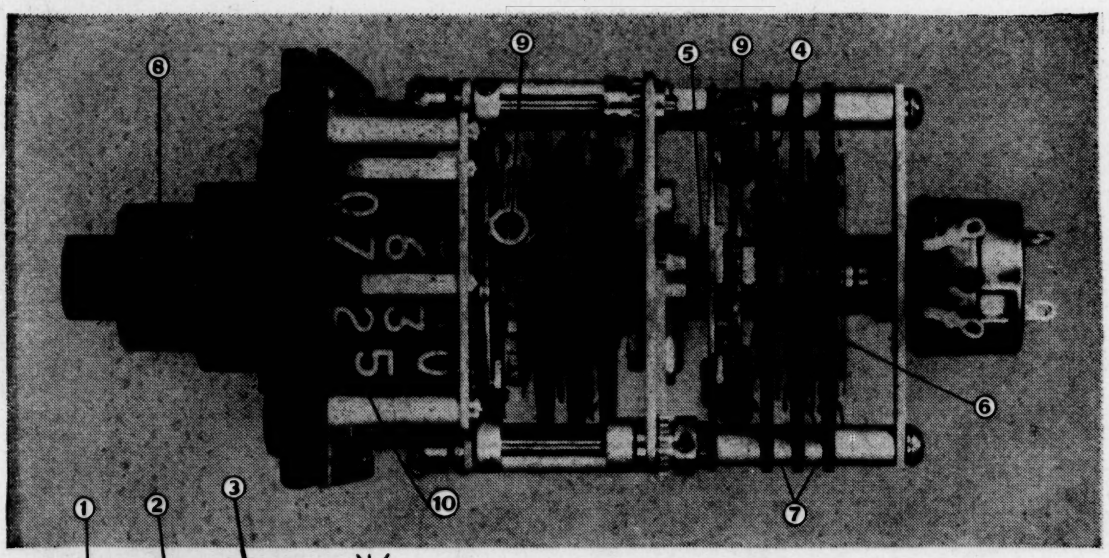

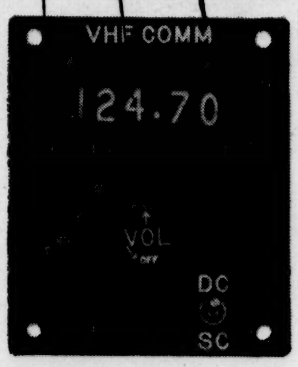

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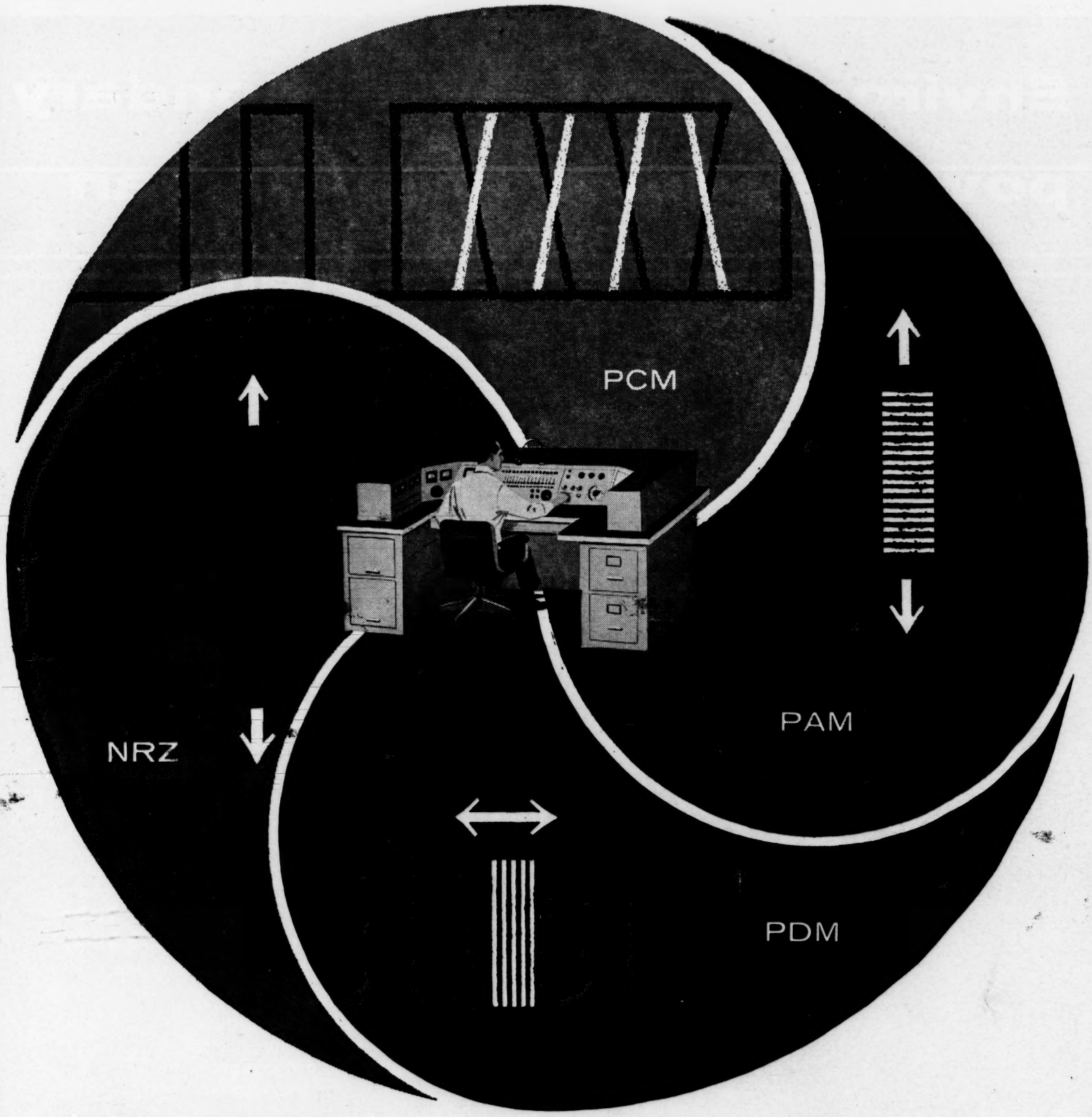

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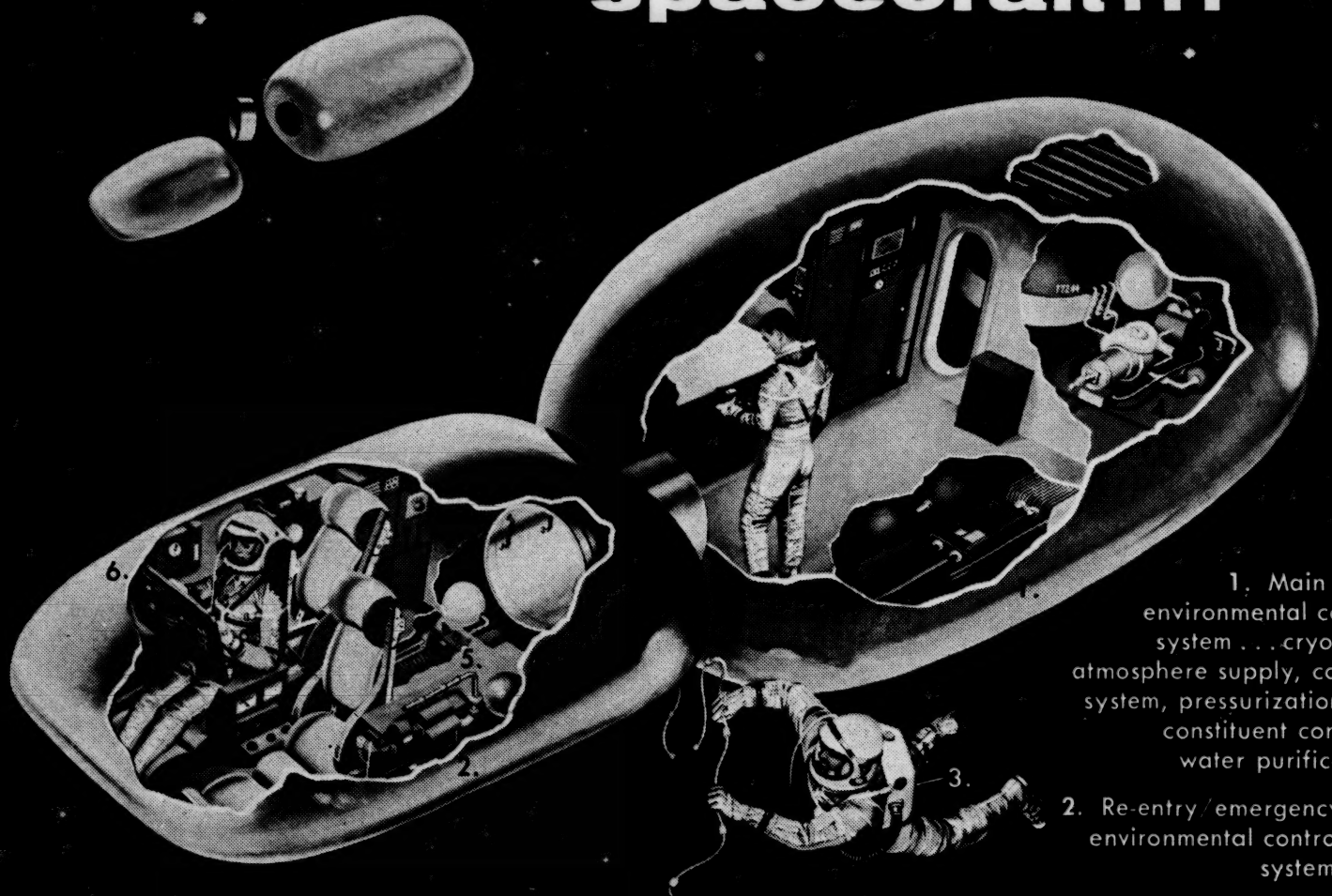

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Set-up and operation of electronic Analog Computers to solve problems concerned with mathematical models and physical simulations.

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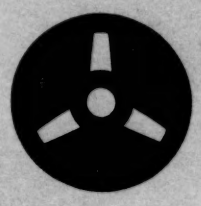
Development, maintenance and operation of data processing systems which dictates computer programming requirements and relates operation of conversion system to computer system in providing engineering analyses.

Operational evaluation of instrumentation, acquisition, and processing systems. Automation of processing and analysis techniques.



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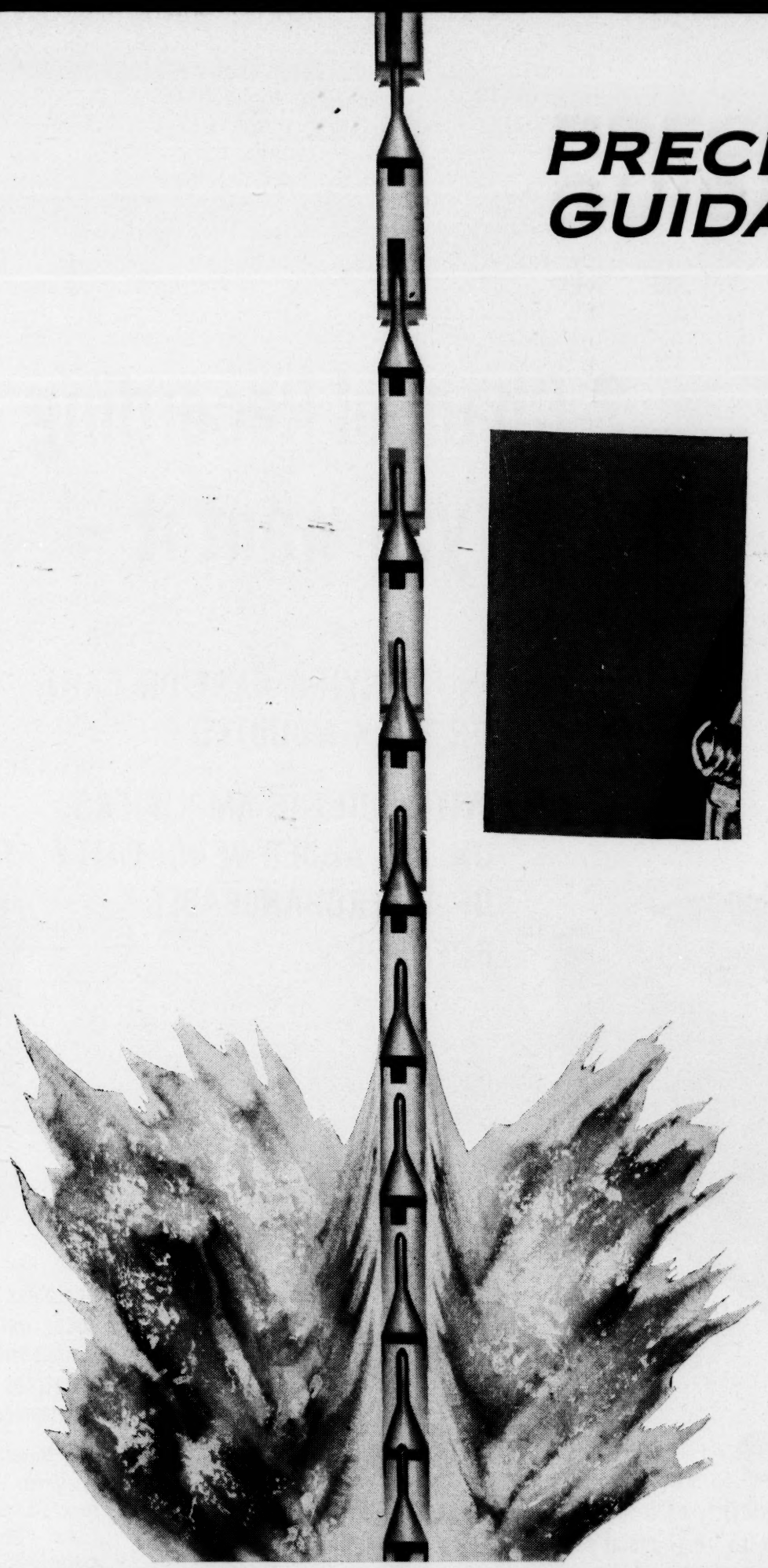

POLARIS "ON COURSE"—TIME AFTER TIME AFTER TIME

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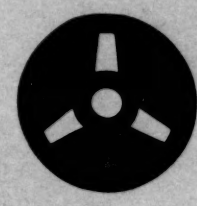

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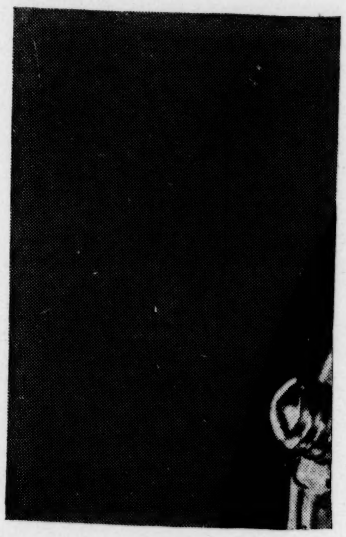

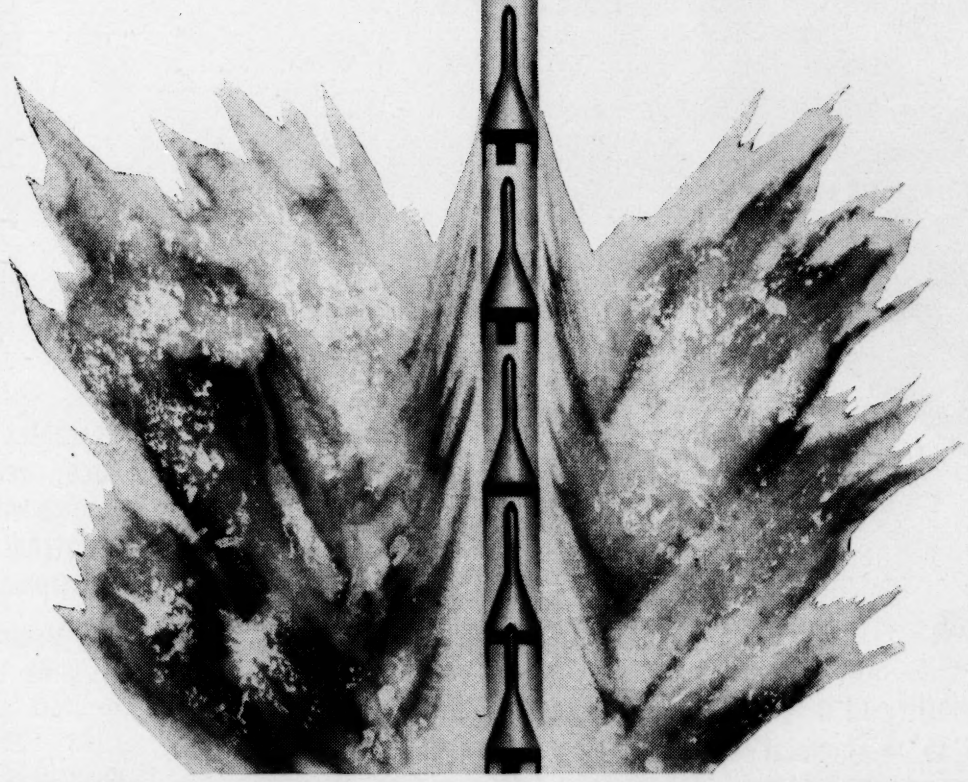

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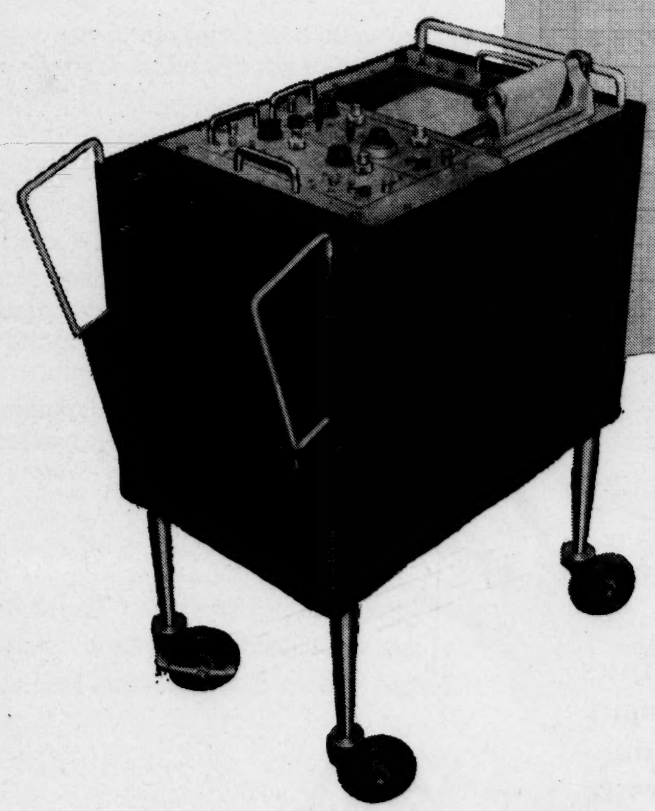

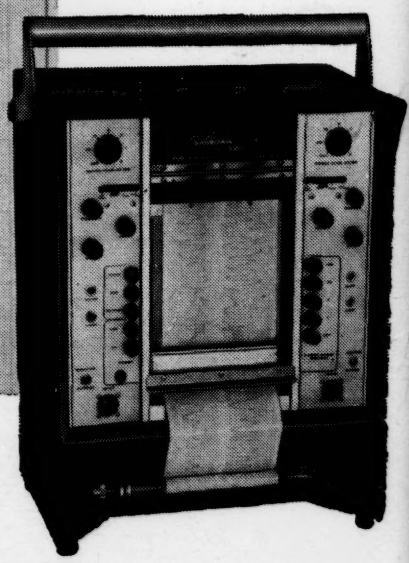

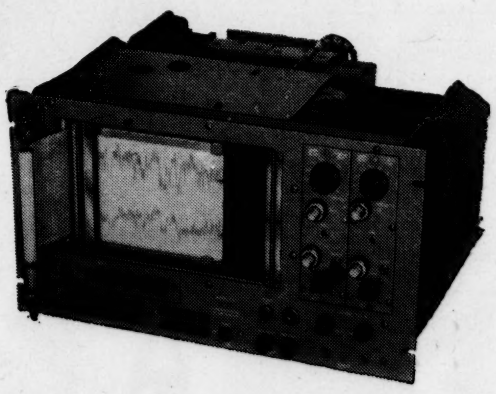

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▶**Vital Military Electronics Research Areas Pinpointed**—Most important areas of research in electronics from the point of view of national needs were pinpointed in a recent survey of leading scientists and engineers by the Office of Director of Defense Research and Engineering. Of 206 separate comments in 22 categories submitted by 49 persons, 142, or roughly 70% of the comments centered on nine categories as follows: bio-electronics & related subjects (adaptive controls, self-learning devices, etc.); solid-state; communications and command and control; reliability; computers and data processing; energy conversion and storage; optical masers and submillimeter wave devices; materials research and microminiaturization. Comments are printed in a report entitled "Important Areas of Electronic Research."

▶**Venus Radiation at 4.3 mm. Reported**—Naval Research Laboratory scientists have measured energy radiated from the planet Venus at a wavelength of 4.3 mm., believed to be the first time that such energy has been measured. New data is expected to aid in determining the temperature of the planet which has been estimated at between 280F and 600F, based on measurements at other wavelengths.

▶**Winter Study Group Report Available**—An abstract of the Air Force's Winter Study Group Report, analyzing existing and planned USAF command and control systems, is available to companies having an established "need to know" and access to "Confidential" material. Such companies may request copies from Deputy for Advanced Planning, Electronic Systems Division, Hanscom Field, Bedford, Mass.

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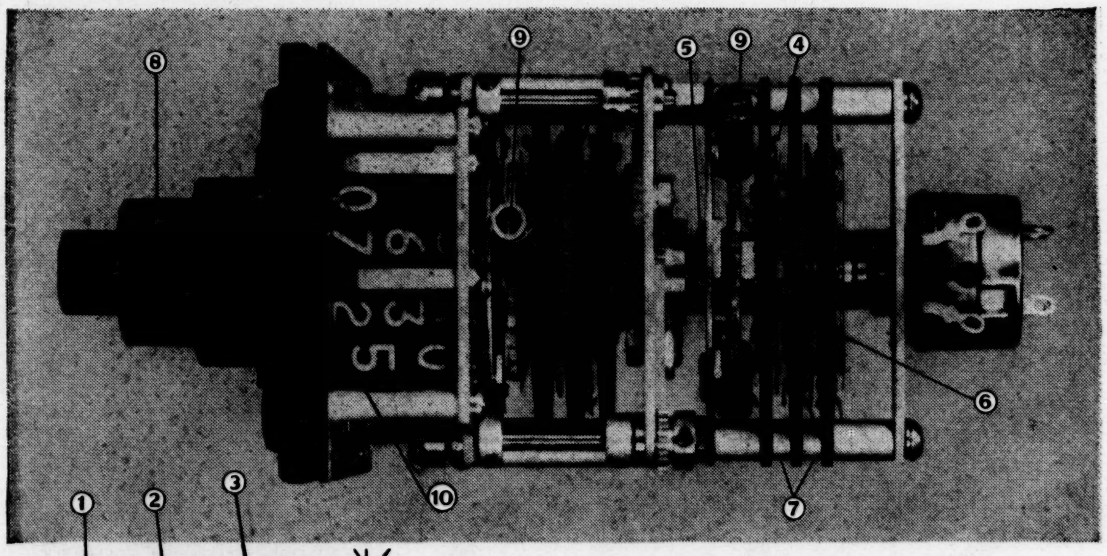

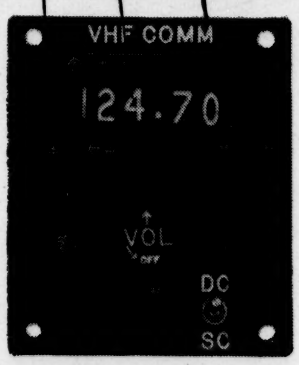

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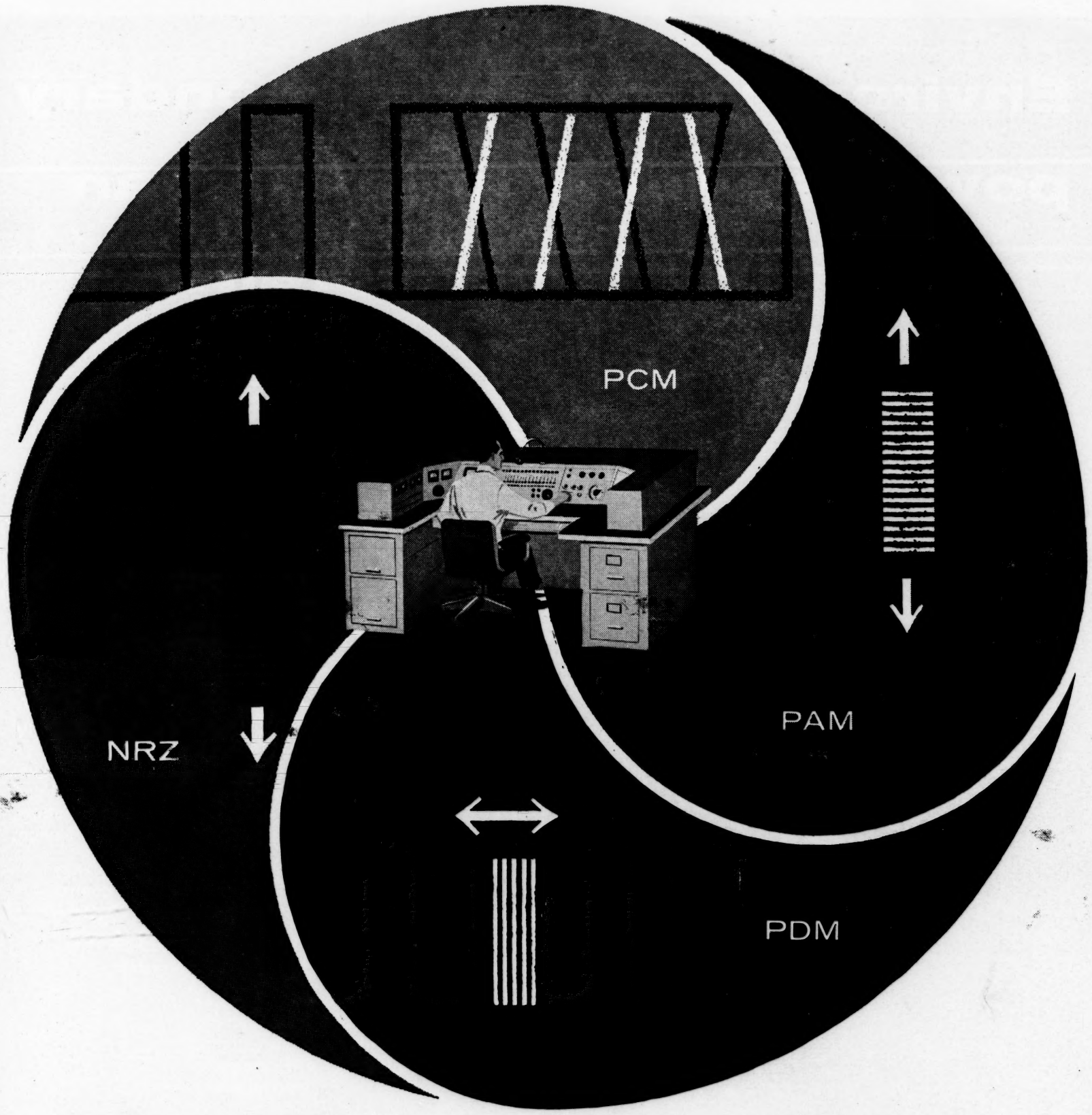

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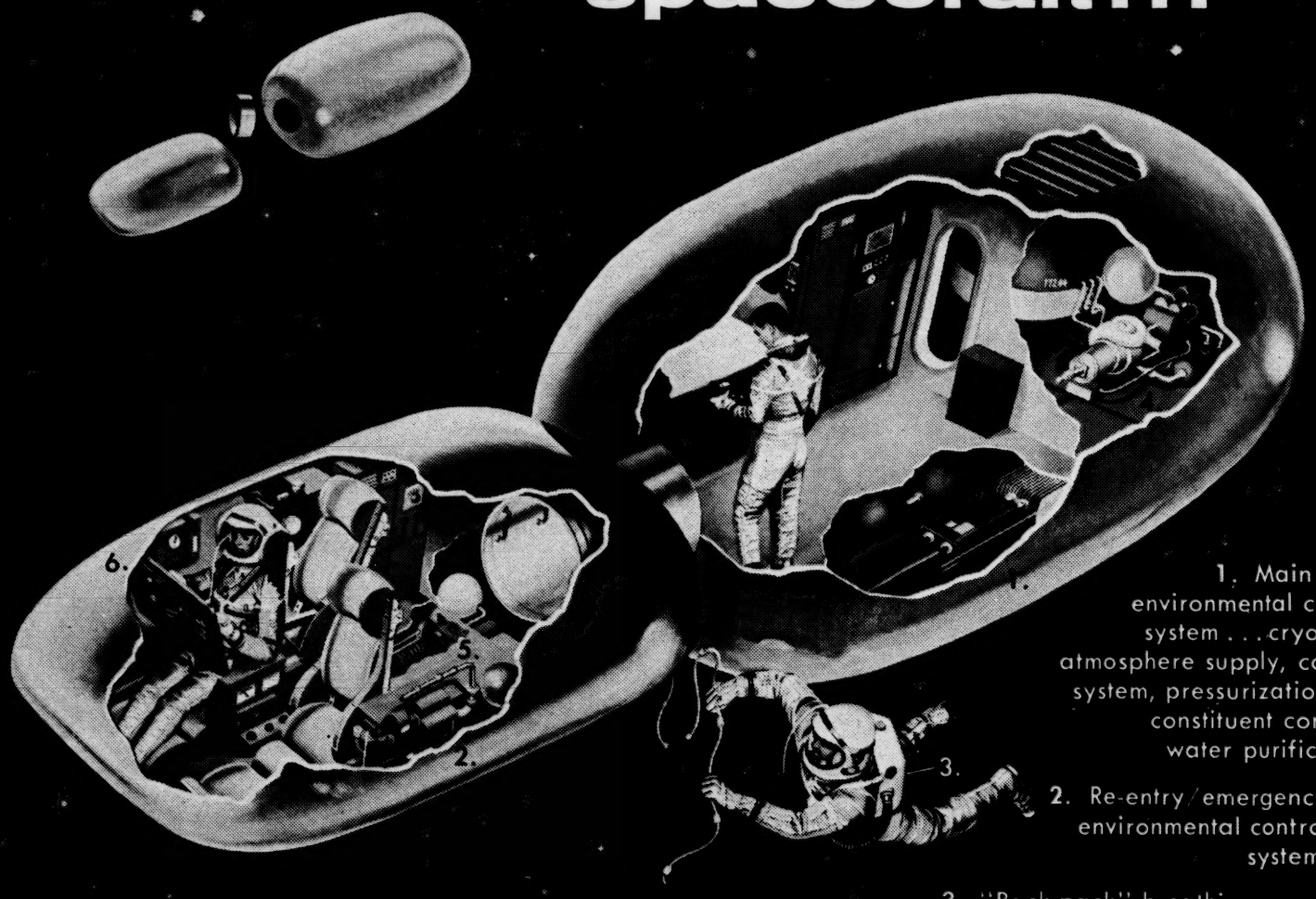

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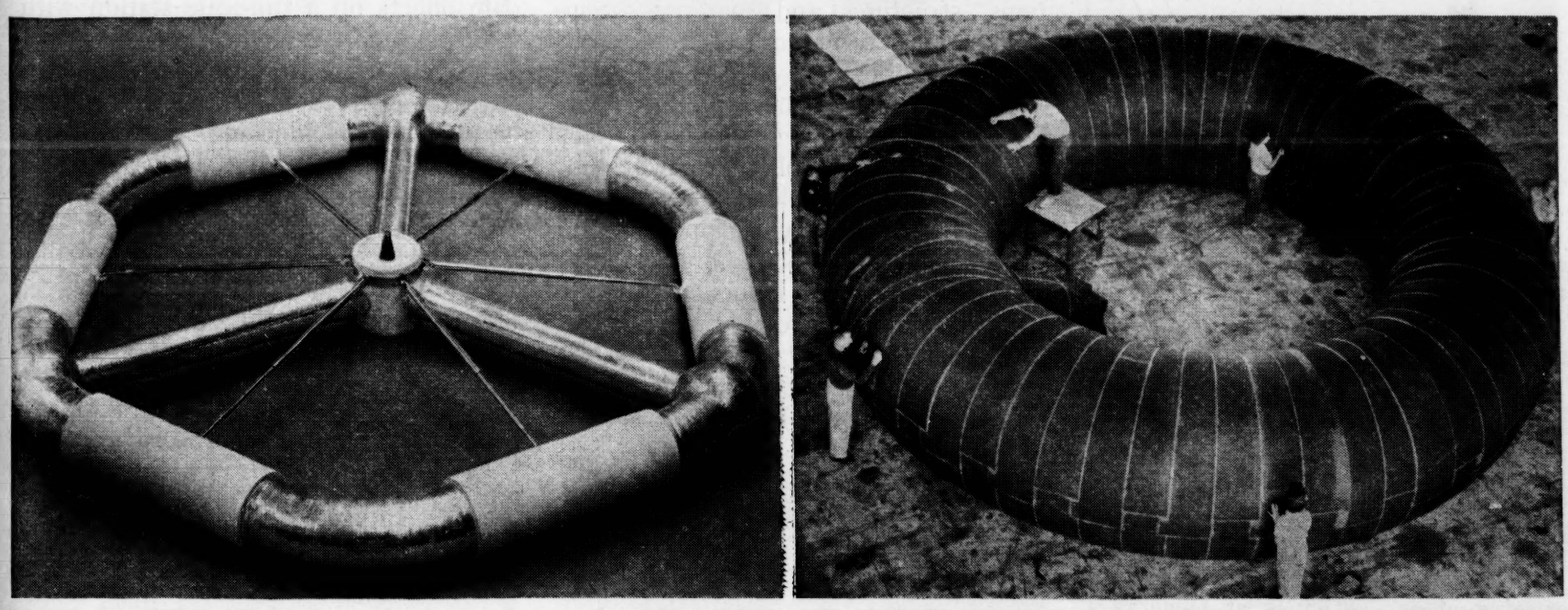


SPACE STATION STUDIES involving the design of orbiting laboratories include concepts of a solid-erectable design (left). Vehicle cylinders would be stacked for launch and erected after insertion into orbit. Another concept includes Goodyear Aircraft Corp.'s model of an expandable torus for folding, deployment and ventilation studies (right).

NASA Explores Space Station Problems

By Edward H. Kolcum

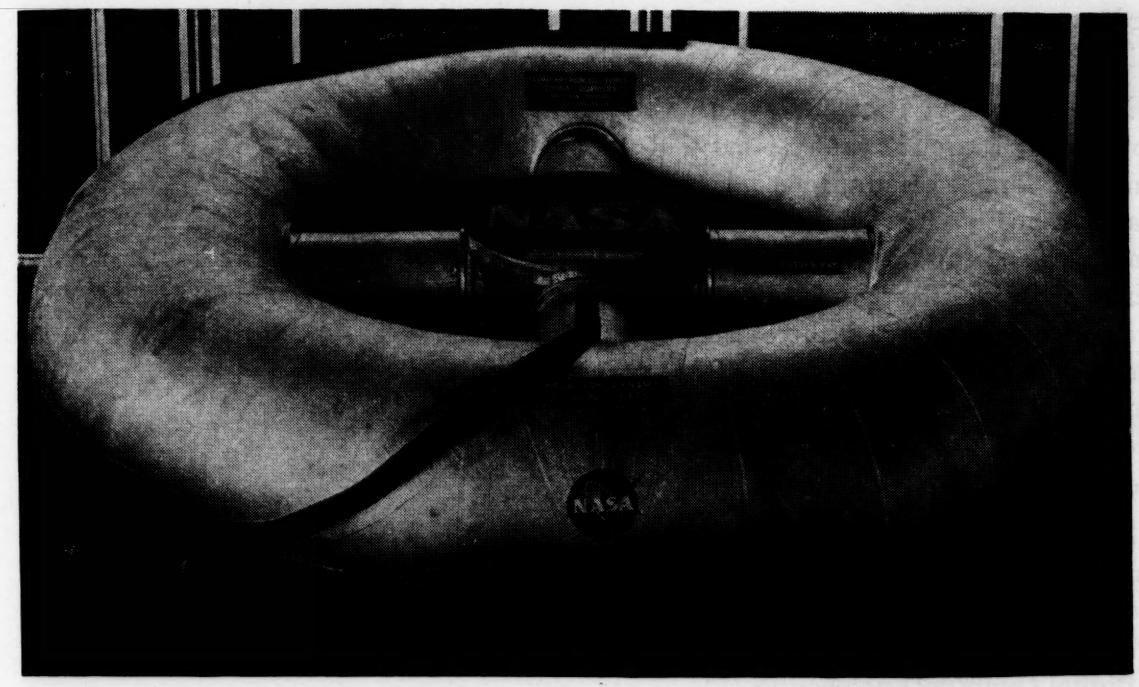
Langley Field, Va.—Basic research conducted here on the design problems of manned orbital stations is expected to contribute valuable environmental data to National Aeronautics and Space Administration's manned lunar landing program.

Langley Research Center space station office has undertaken a seven-part program aimed at isolating and solving basic problems involved in designing long-lived orbiting laboratories carrying one to six astronauts. Although research centers around models or erectable structures, actual configurations and mission planning are not primary goals of the broad program.

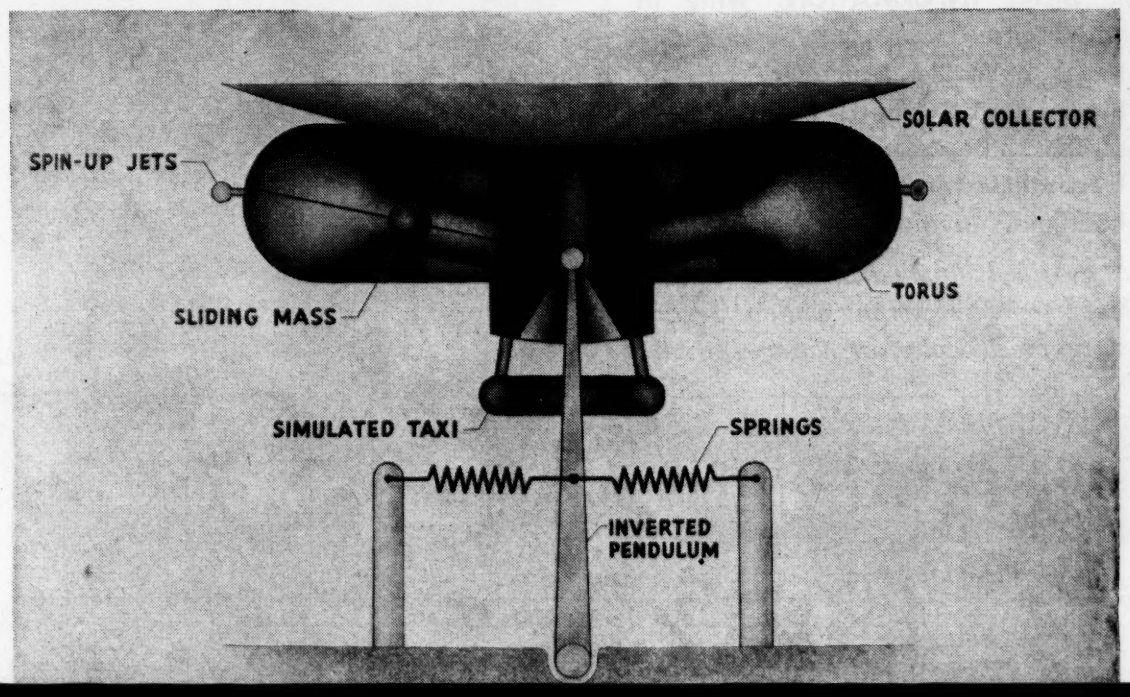
Joseph A. Shortal, chief of the Applied Mechanics and Physics Division, which includes the space station office, sees a need for manned orbiting laboratories beyond the background information they can provide for the Apollo program (AW June 19, p. 26). He looks on the orbiting laboratory as an extension of ground facilities for a broad range of engineering and systems studies.

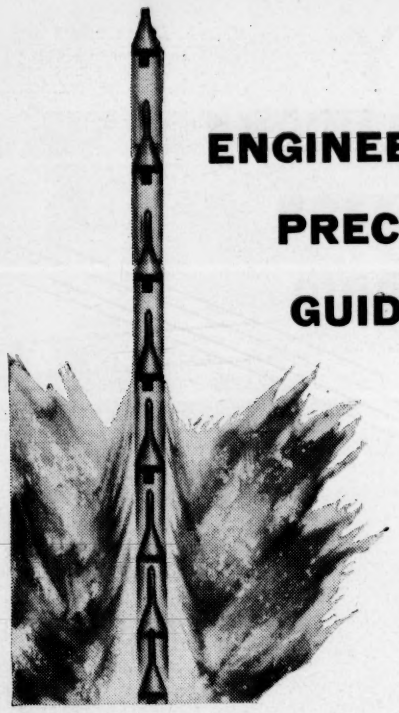
Emanuel Schnitzer, who heads the space station office, told AVIATION WEEK that his group is concentrating on thermal balance, dynamics, stability and variable gravity, power supply, life support and materials requirements for stations with minimum operating lifetimes of a year.

Such stations, he said, would provide facilities to study the ability of an astronaut to adapt to long periods of reduced gravity, radiation, and life



TEN-FOOT DYNAMIC TEST MODEL of NASA's manned space station. Electric "mouse" will move over the track to determine the effect of weight on stability (above). Dynamic test rig (below) is being installed at Langley Research Center to test a 10-ft. torus model of a manned orbital laboratory. The facility will be used to assess frequencies, docking impacts, stabilization. Grumman is building a 34-in. model for thermal chamber tests.





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Inertial guidance activities at General Electric's Ordnance Department represent some of the most exciting and challenging work areas for engineers with creative abilities. In addition, the Polaris MK 2 Guidance System demonstrates the Navy's long-range requirements for the kind of precision that Ordnance Department engineers and scientists can deliver.

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167-02

GENERAL ELECTRIC

in an artificial environment. The stations also could be used to flight test stabilization and auxiliary power systems, structures and materials, communications, orbit control, rendezvous and navigation.

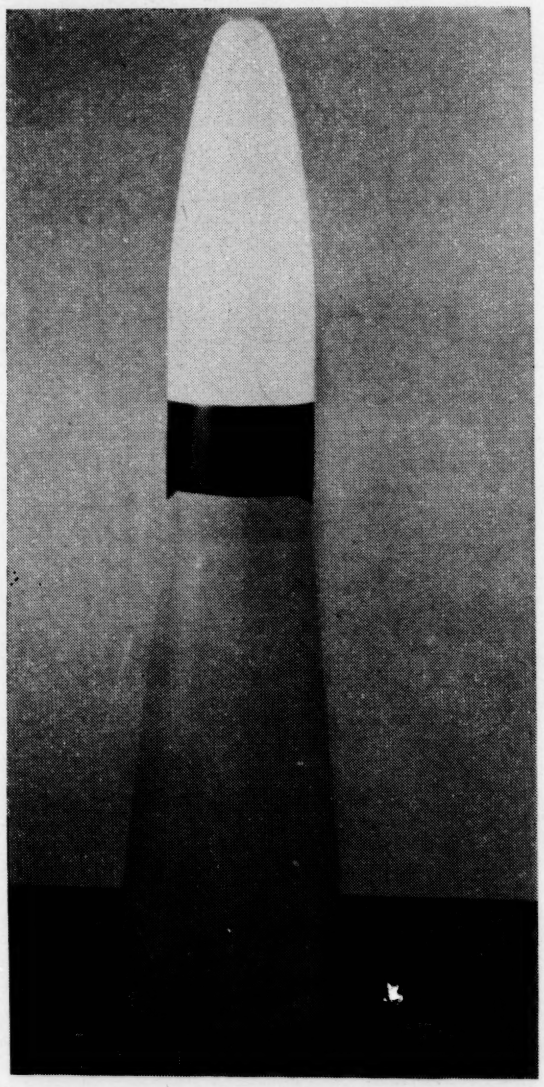
Demonstration model of one Langley space station is a segmented torus with its own solar collector power unit. The collector is folded like an umbrella, with the torus wrapped around it for packing in a nose cone for launch. The crew would be launched in a life support module beneath the collector-torus pack.

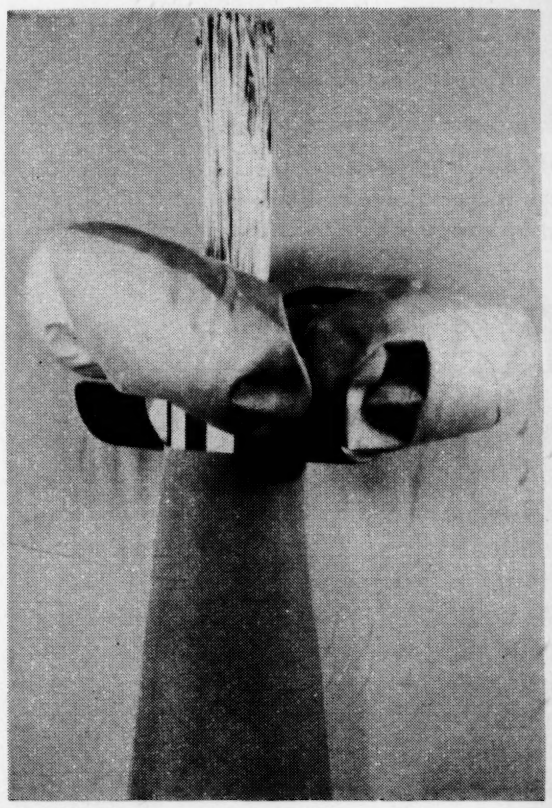
Abort escape ejection in this launch configuration would be out the side.

Langley has completed construction of a 10-ft. diameter torus to be used in dynamics studies, which will simulate effects on a full-scale station with a 30-ft. diameter. The agency has designed a dynamic test rig with five degrees of freedom which will permit assessment of docking impacts and stabilization. Shifting loads will be simulated with an "electric mouse," which will crawl over a track.

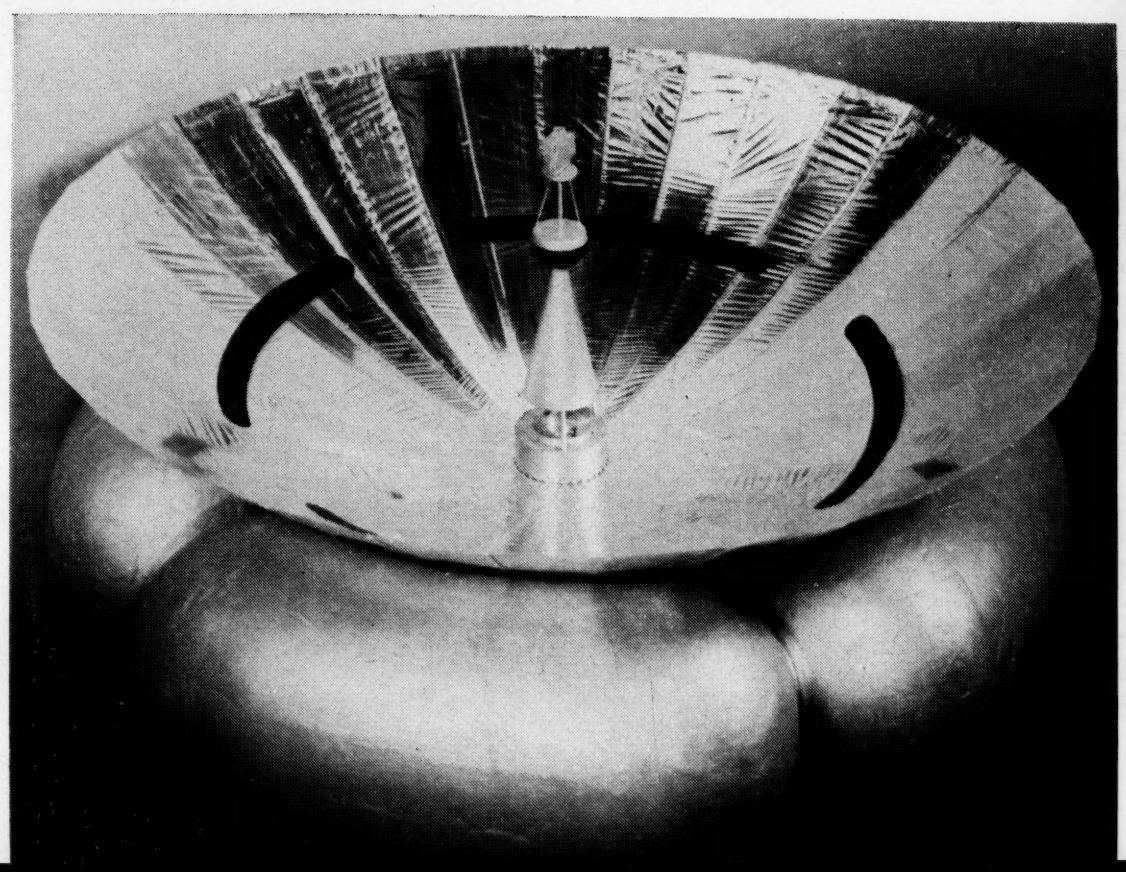
NASA is constructing a second test chamber with a simulated sun source, albedo lamps and the ability to study thermal balance at a pressure of 10^{-6} mm. of mercury.

Grumman Aircraft Corp. is building





SEQUENCE, left, above and below, shows inflation process for a manned space station model used at Langley Research Center. Solar collector is folded like an umbrella, and the station is wrapped around the collector during launch. Compartments are utilized for protection against micrometeoroid puncture activity.



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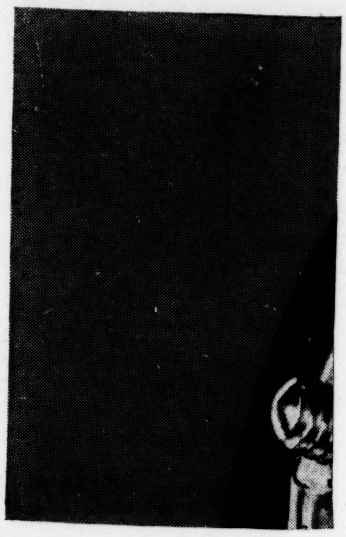

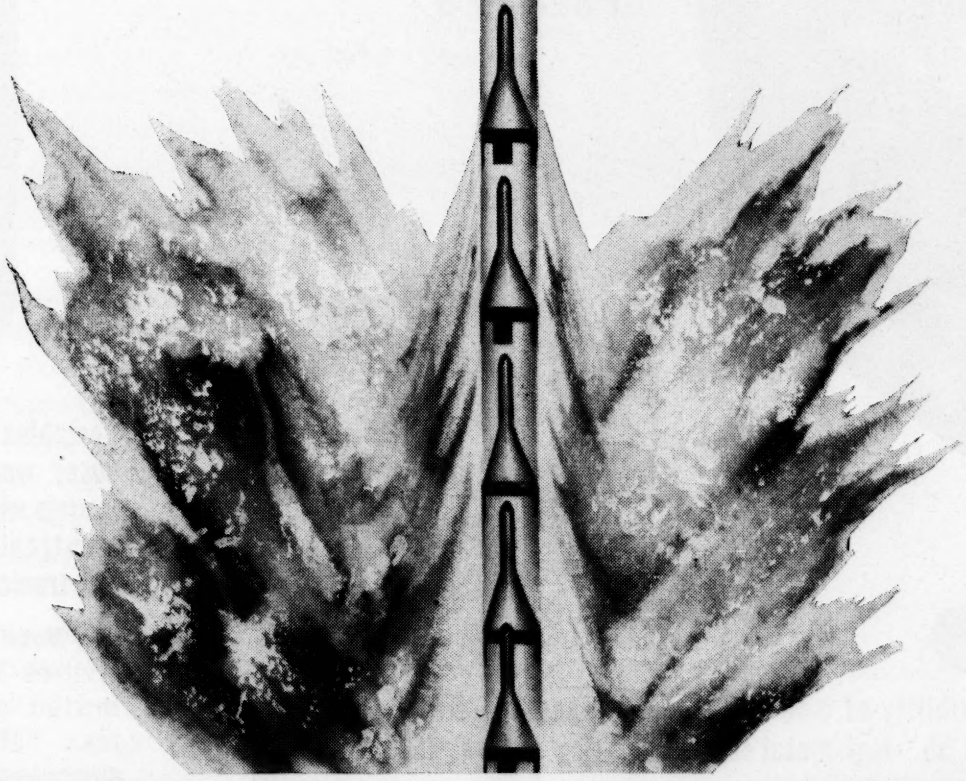

POLARIS "ON COURSE"—TIME AFTER TIME AFTER TIME

Over 40 Polaris missiles—with completely operating inertial guidance systems designed by Massachusetts Institute of Technology and produced by General Electric—have been flight tested from land, on the sea, and under the sea.

The repeatedly precise, reliable performance of this MK 1 Inertial Guidance system now is being applied to the advanced MK 2 Polaris Inertial Guidance system by M.I.T., G.E. and Raytheon.

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Polaris Inertial Guidance is typical of the many precision products —antennas, fire control, inertial guidance, launching and handling equipment, torpedoes—being produced by General Electric's Ordnance Department.

166-21

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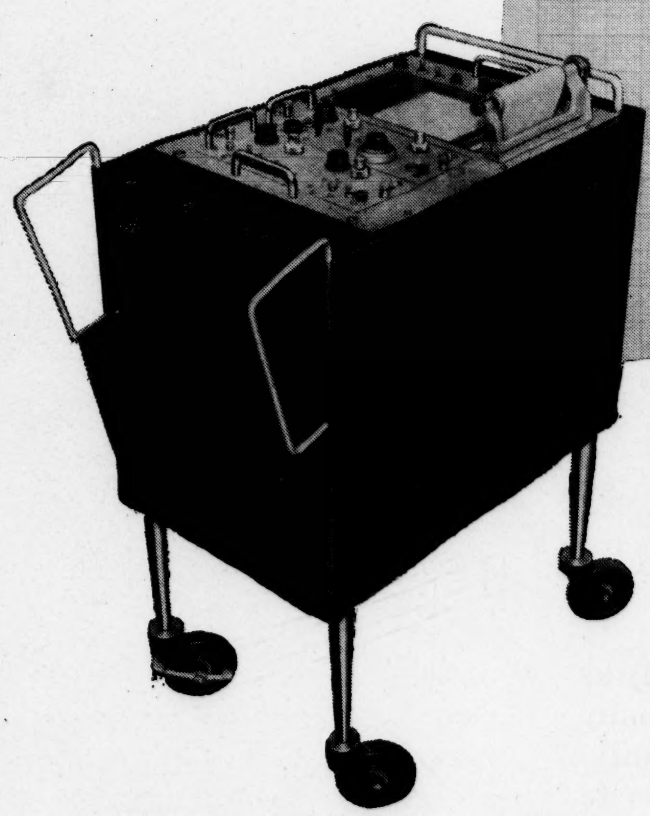

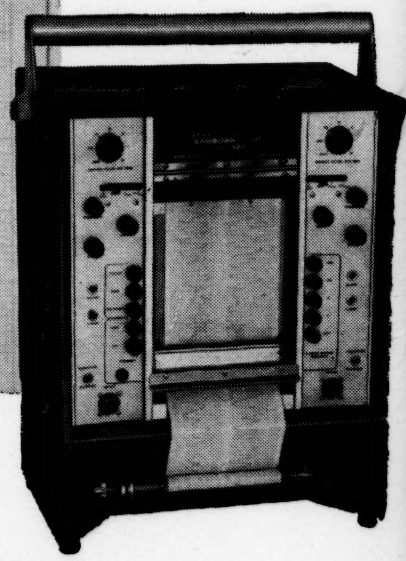

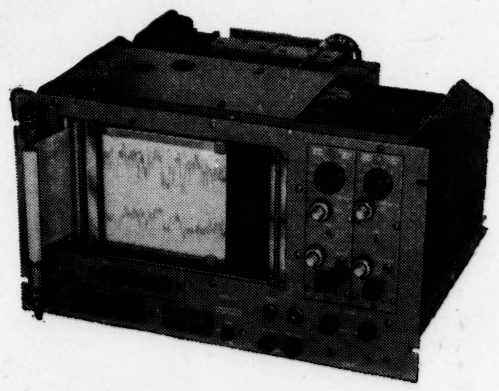

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New Model 321 Carrier for AC transducer work: maximum sensitivity 10 uv rms/mm; excitation 5 volts; transducer impedance 100 ohms min; uncalibrated zero suppression.

Model 320 General Purpose DC (illustrated): 12 sensitivities 0.5 to 20 mv/mm and v/cm; input impedance ½ megohm (mv/mm ranges) and 1 megohm (v/cm ranges); floating and guarded inputs.

All models occupy approx. 1 cubic foot, can be placed horizontally, vertically, or resting on handle at 20° angle; all accept optional paper take-up (shown).

a 34-in. model of the station for thermal chamber tests.

Schnitzer said one of the group's major studies concerns variable gravity effects, which could be induced by the crew by activating spin rockets. Tests under way at the Langley outdoor centrifuge indicate a 40-ft.-diameter torus would have a uniform 0.25g force if it were rotated at 6 rpm. Long-term effects of the zero-gravity environment is one of the basic unknowns in extended space flight, and Schnitzer said the torus is the ideal configuration if gravity is to be induced.

A cylindrical shape appears best without gravity, but any shift in internal weight produces large amplitude wobbles, he said.

The dynamics test program includes assessment of a wobble damper, to eliminate rigid body wobbles by use of an air bearing flywheel with gyros.

Goodyear Aircraft Corp. is building a 24-ft. expandable torus under a NASA contract which the agency will use for variable gravity studies and to determine the best methods of folding, deployment, erection, ventilation and maintaining an 8-psia. atmosphere.

Goodyear feels a multi-man space station can be launched in 3 yr., using an erectable structure which could be made rigid by injecting quick-setting plastic between the material walls.

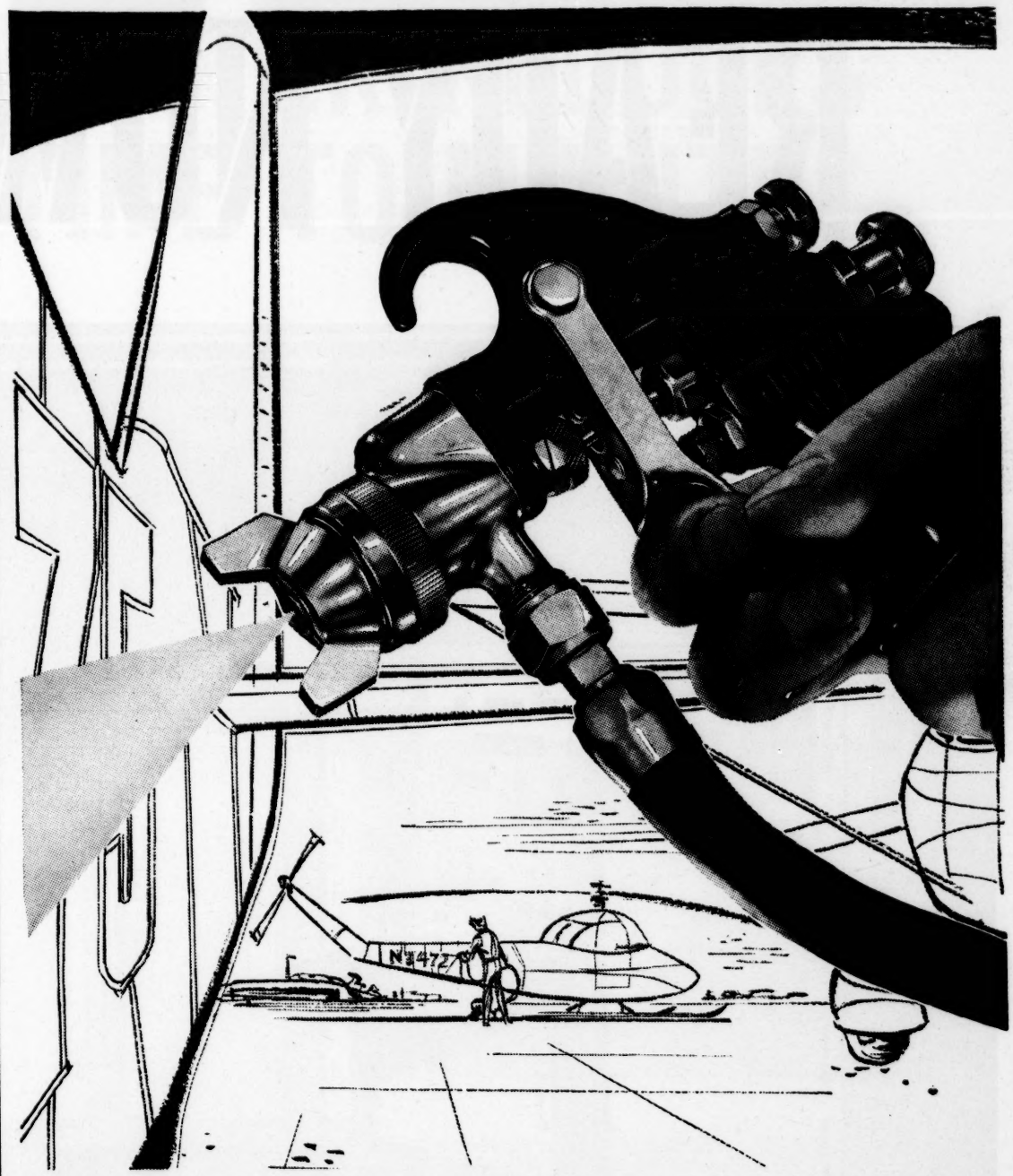
Schnitzer's group is looking at a variety of fabrics and elastomers in materials research and recently awarded a study contract to American Machine and Foundry Co. for a closed-cycle water recovery system in the life support phase of the program. The agency also is studying removal of carbon dioxide from the station with a molecular sieve. Among materials under study both by NASA and industry, are three-ply dacron-butyl, untwisted dacron, silastic laminates and isotensoid weaves.

Although configurations and missions are considered by-products of the group's research, some unique concepts have been developed during the studies. One is a single-astronaut station based on the Mercury capsule, surrounded by an inflatable C-annulus torus. The entire station would weigh 8,000 lb. and could be launched into a 400-mi circular orbit with Saturn C-1.

The group feels that such a station could provide critical data on ear canal sickness in a weightless environment and prove schemes of passive heat and refrigeration.

Another unusual concept is the use of inflatable furniture, which would be erected and made rigid along with the basic structure. Chairs, bunks and desks would be built of fabric and folded for launch.

The group also is studying a solid-erectable configuration, with alternate 20-ft. metal and fabric cylinders.



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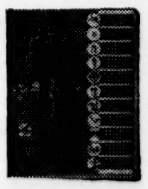

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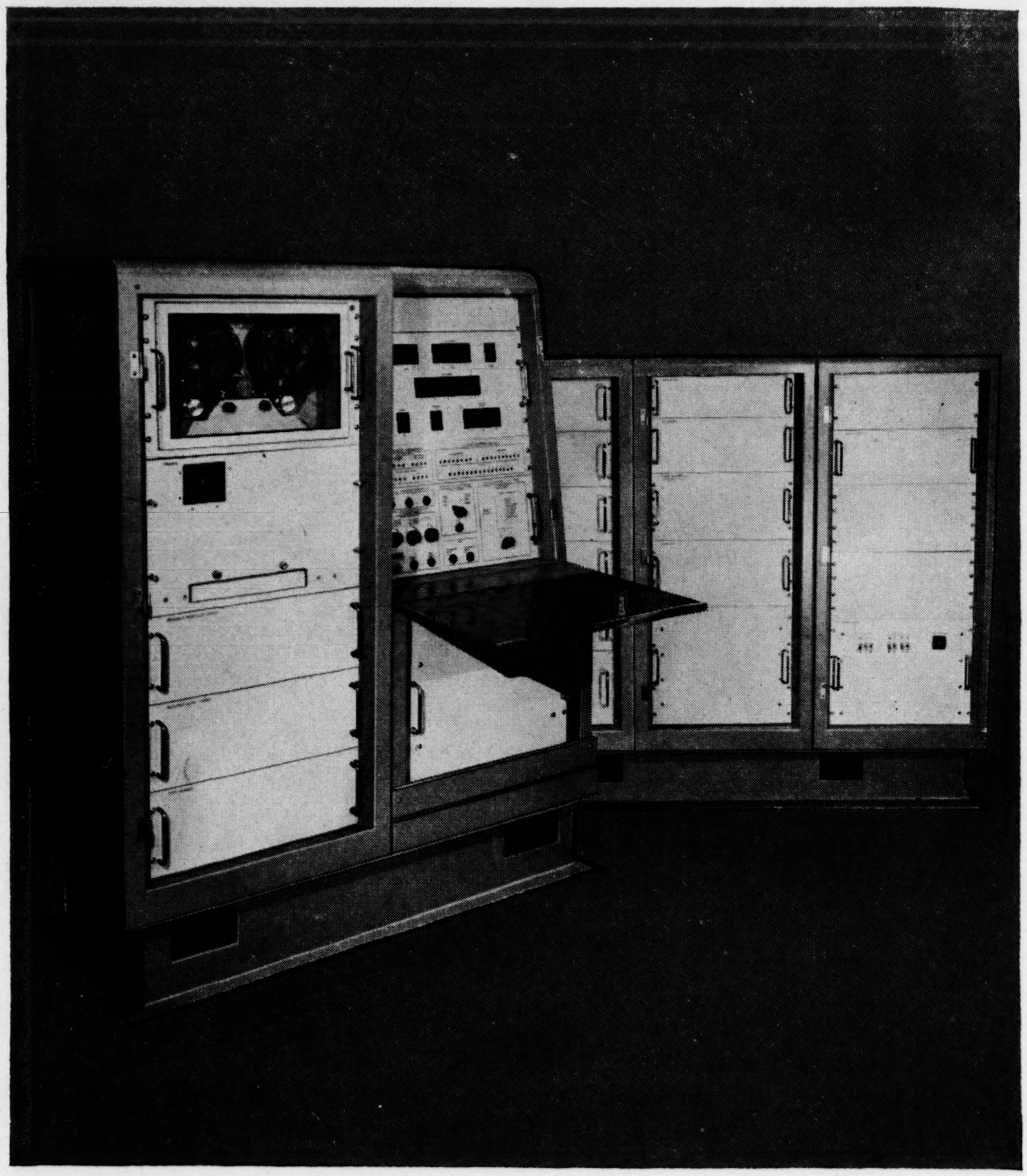

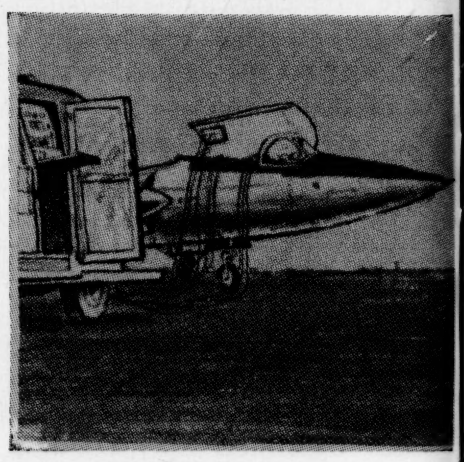

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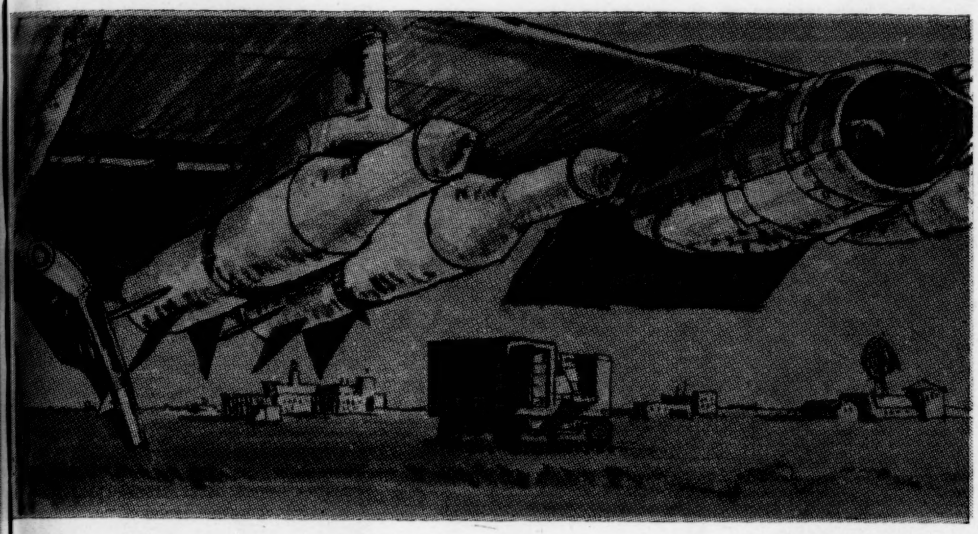
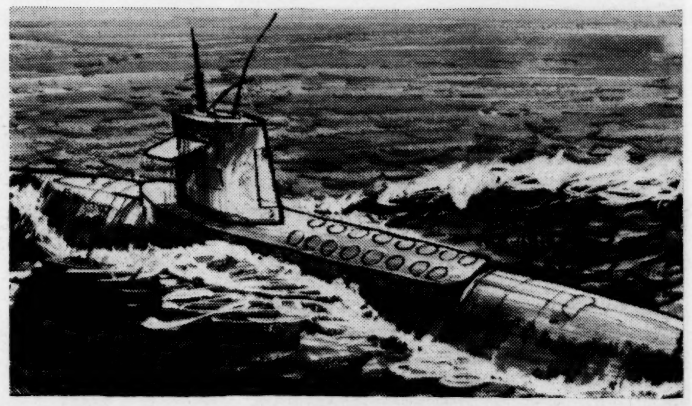
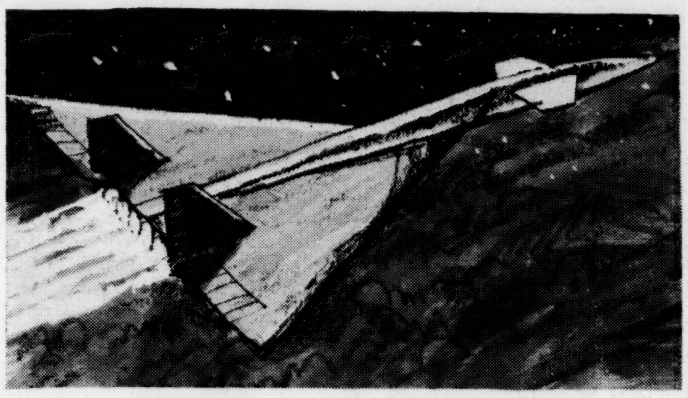
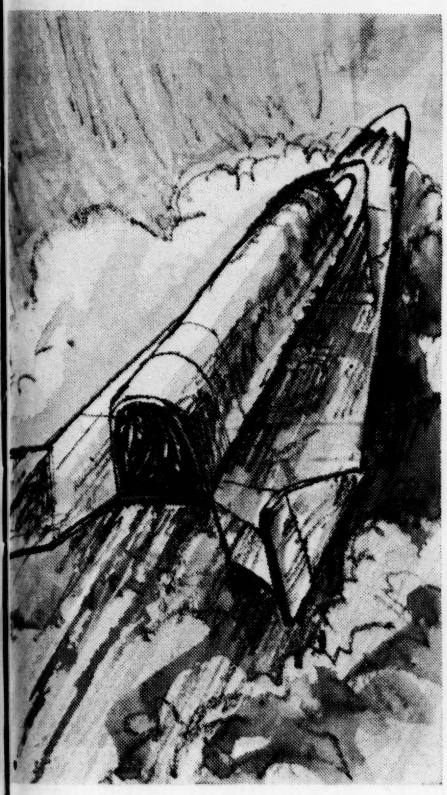
1. Checkout time for complex systems is reduced from hours to minutes. **2.** Minimum skilled technicians can perform complete systems checks with high accuracy. **3.** Visual display and printed record of the test results are provided for the entire testing sequence. **4.** Applicable to in-plant manufacturing as well as to all levels of maintenance activity. **5.** Modular construction permits packaging for either fixed or mobile units.

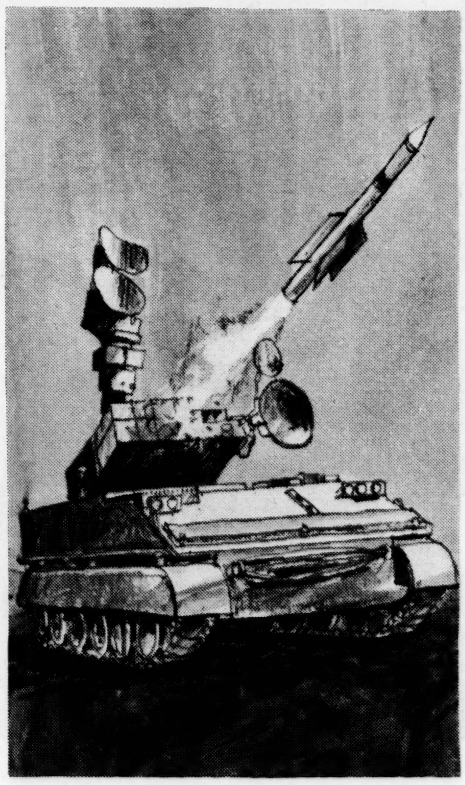
UNIVERSAL TESTER REDUCES CHECKOUT TIME TO MINUTES

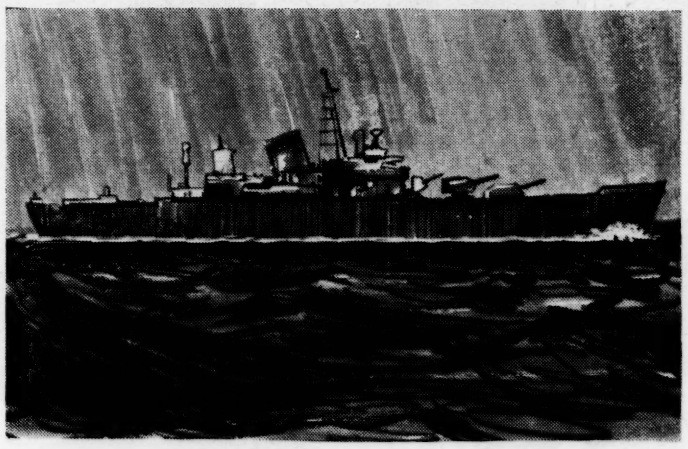












TESTING ALL TYPES OF AIR, LAND, SEA, AND SPACE SYSTEMS

The first application is the USAF's Douglas-built Skybolt Missile. Built to Mil-P-26664A, and designated AN/GJQ-9 by the USAF, the Universal Programmer-Comparator is available as Model PC-300 for commercial applications.

This Universal Tester is the latest Bendix achievement in the Support Equipment field and is another example of the engineering and production skills we have developed over a period of forty years. Whether the need is military or commercial, Bendix can provide the answer that does the job *best.*

TECHNICAL **KNOW**LEDGE + EXPERIENCED **MAN**AGEMENT + SPECIALIZED CRAFTSMAN**SHIP** = **KNOWMANSHIP**

For further information, write...

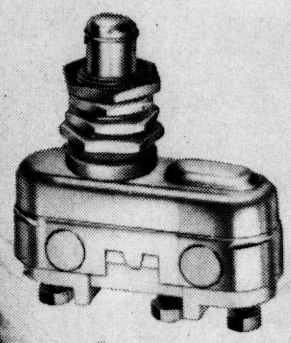
THE Bendix CORPORATION

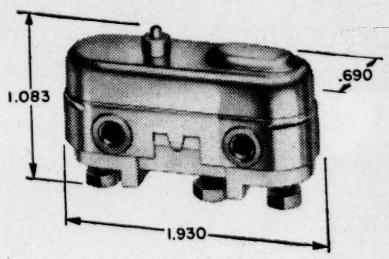
BENDIX SUPPORT EQUIPMENT

Eclipse-Pioneer Division

TETERBORO, N. J.

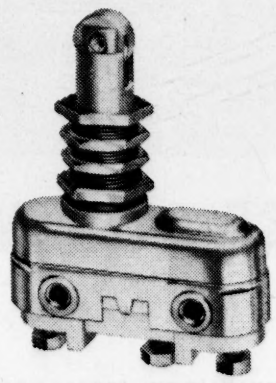
SWITCH RELIABILITY AT 1000°F



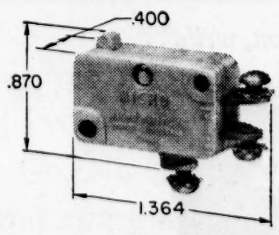


PIN PLUNGER

Switch featured at right has Overtravel Plunger



ROLLER PLUNGER



"V3" Small basic switch with synthetic mica case withstands operating temperatures to 600°F

These high temperature switches were originally designed for use on or near the afterburners of jet aircraft. Their precision performance in a temperature range of −65°F to +1000°F makes them ideally suited for high temperature applications. To insure reliability and precision, only laboratory-tested heat resistant materials are used in their manufacture. Switching elements are mounted on ceramic terminal blocks and protected with corrosion resistant monel enclosures. Actuators, terminal screws and nuts are stainless steel. At 1000°F, these switches exceed 10,000 operations while carrying a resistive load of 10 amps at 28 vdc. See the Yellow Pages for the nearby MICRO SWITCH Branch Office, or write for Catalogs 63 and 78.

MICRO SWITCH . . . FREEPORT, ILLINOIS . . . A division of Honeywell

In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

HONEYWELL INTERNATIONAL

Sales and service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Honeywell

MICRO SWITCH Precision Switches

Astra Designs Lunar Atmosphere Simulator

A 500-ft.-diameter lunar atmosphere simulator, big enough to house working parties and heavy equipment in typical planetary or lunar terrain features, has been designed by Astra, Inc. and Synergetics, Inc., of Raleigh, N. C.

Basic structural component is a pair of geodesic trussed spherical shells, one submerged in the earth like a swimming pool and the other enclosing the surface with a dome. Pump houses, air locks for men and equipment and emergency exits or entrances would be spaced around the periphery.

Internal atmospheric pressure could be dropped to less than 2 psi., and the atmospheres of planets could be simulated.

It would not be possible to obtain the hard vacuum characteristic of the moon because of structural limitations.

Interior of the double-shell structure is divided into zones, each with a typical terrain feature: crater, tunnel, crevice, mountain, and plain. Panels in the 140-ft.-high ceiling contain radiant heat sources, which can be lowered to focus heat on a sector. Refrigerant coils buried in the soil would keep the temperature to simulated surface values approximating a dark-side environment.

Flare to Simulate Flash of Zeus Warhead

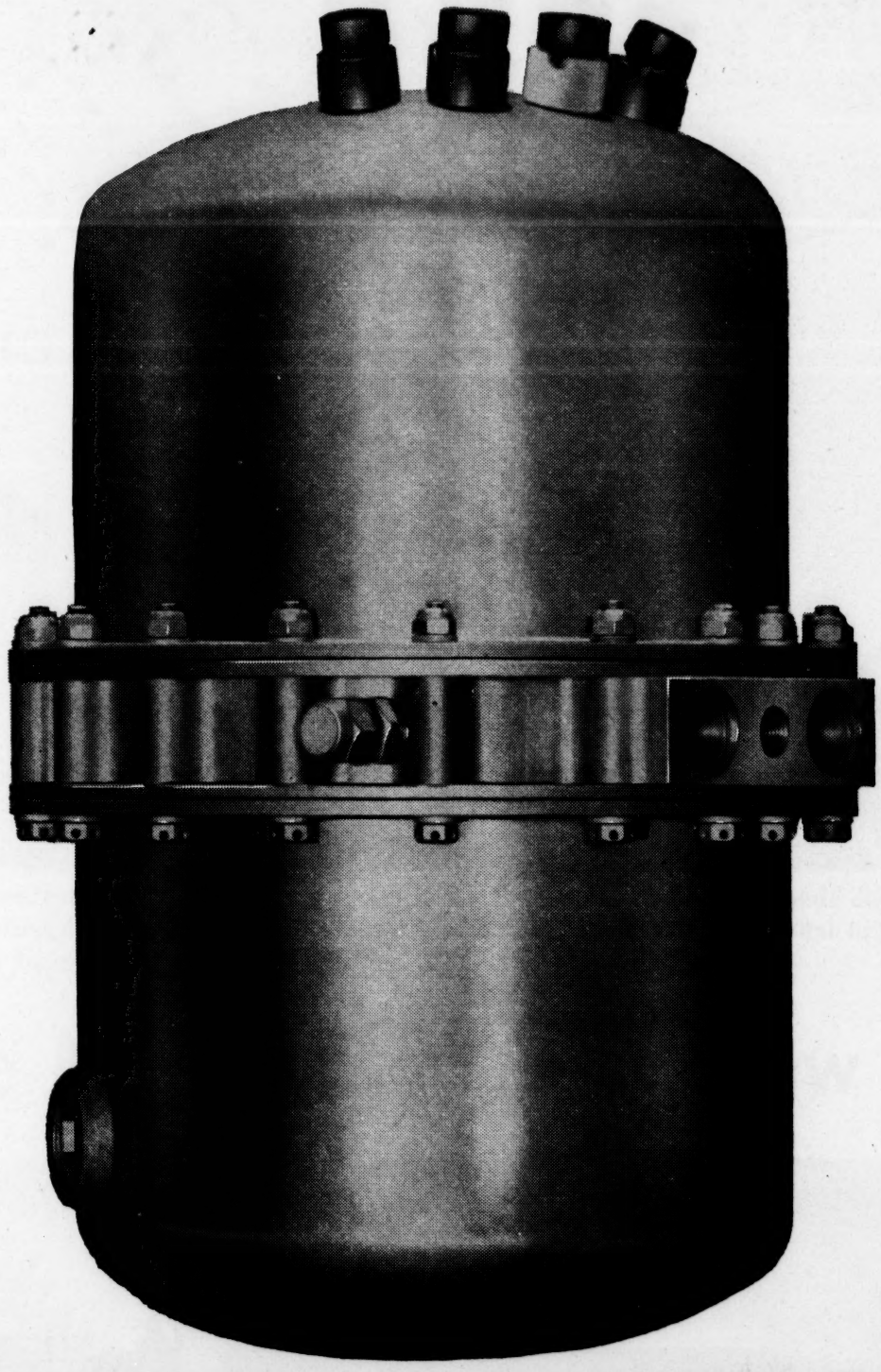
Army has made 71 successful firings of a high-power magnesium spotting device, visible to 40 mi., for use in the forthcoming Nike Zeus tests at Kwajalein Island against ICBMs. The flash charge, designed and developed in several configurations by Bell Telephone Laboratories, Whippany, N. J., will be triggered at altitude to simulate explosion of the Zeus warhead. It will serve as a miss-distance indicator as well as visual confirmation of command signal reception by the warhead.

Turbogenerator Powered By Solid Propellant

Turbogenerator for one-shot missile applications will be developed by Garrett Corp.'s AiResearch Mfg. Co. under contract from Army Ordnance's Picatinny Arsenal, Dover, N. J.

The turbogenerator will be powered by a solid propellant and will supply 150 watts for 100 sec., for delivery in a.c. and d.c. outputs.

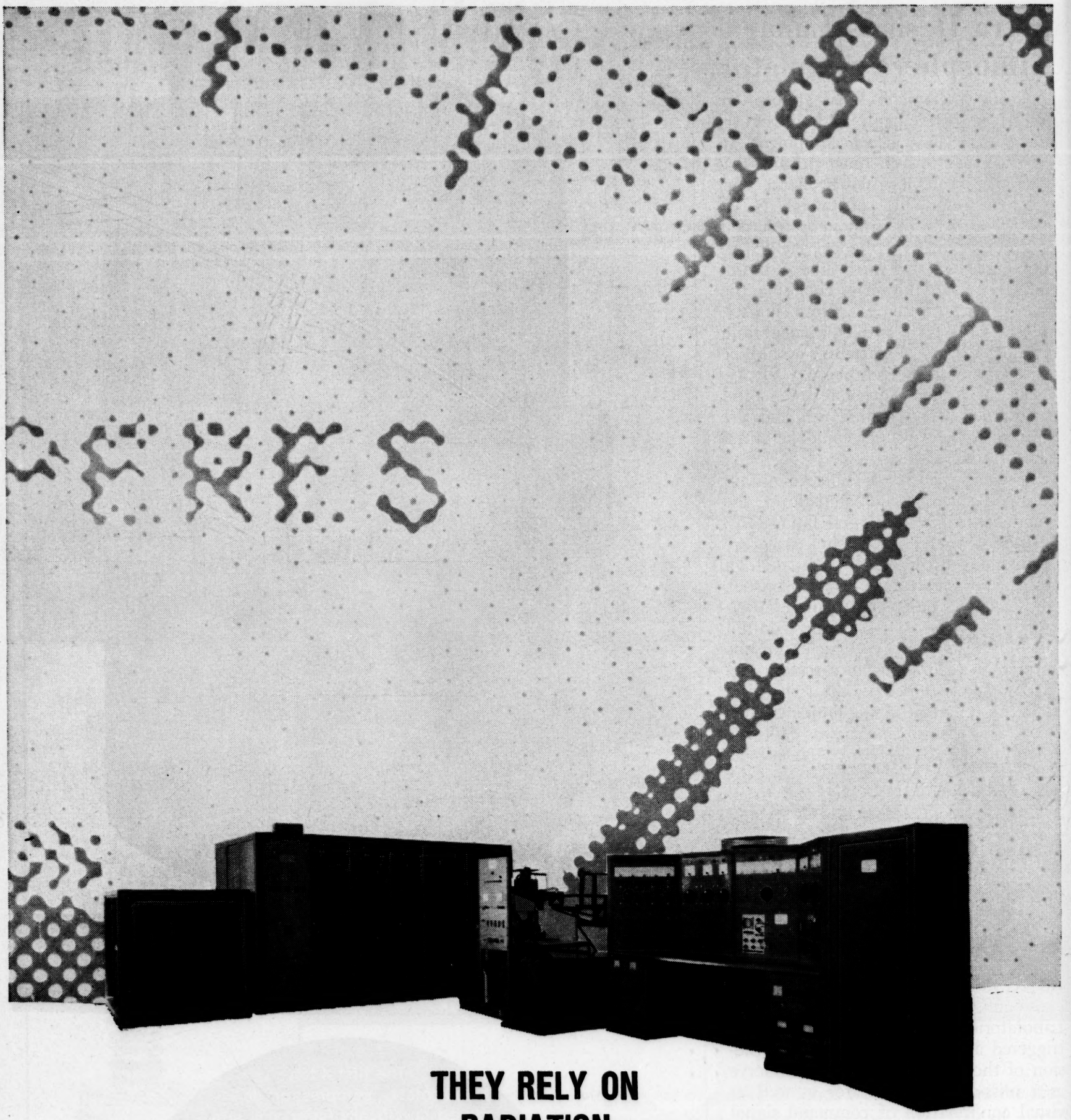
Unit will weigh three pounds and will be enclosed in a 25-cu.-in. package comprising gas generator, turbine, electrical generator, controls, regulators and rectifiers.



A New Refrigeration Compressor For Weapon Support Systems

The first 4 ton hermetic compressor designed specifically for ground support applications, this lightweight axial piston unit operates in the low industrial speed zone of 3400-3700 RPM, assuring exceptional reliability and long life. Unique design permits thermal isolation of unit. An integral centrifugal separator returns refrigerant entrained oil to the compressor sump eliminating need for an external oil seperator while increasing heat exchanger efficiency. Compressors are also available in 2½ ton capacities. Four ton unit above is ¼ actual size.

For further information write **Task Corporation,** 1009 East Vermont Avenue, Anaheim, California.



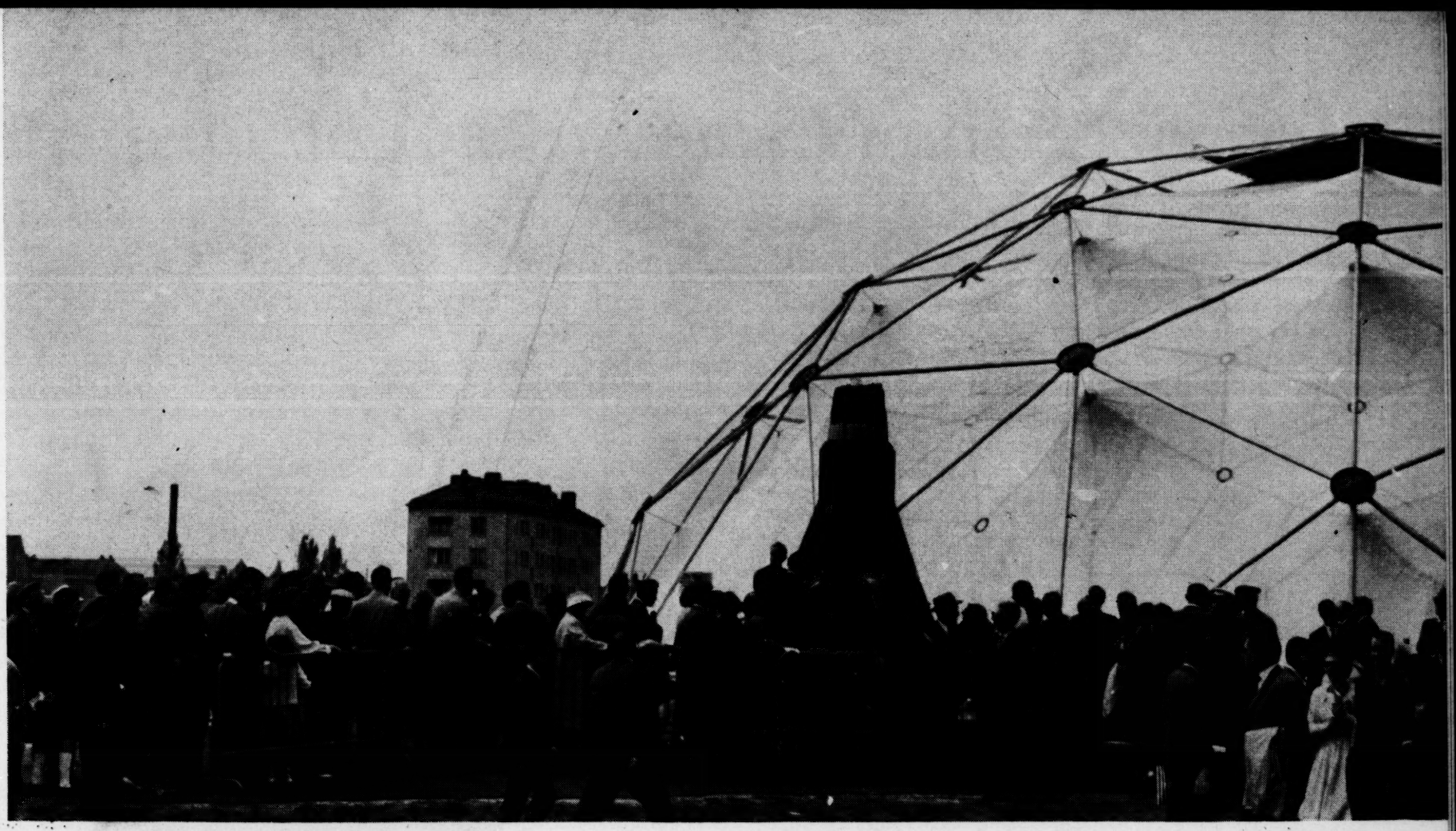
THEY RELY ON RADIATION FOR MEGAWATTS AT MEGACYCLES

Radiation at Stanford (formerly Levinthal) designs and builds high-power radar and communications transmitters, modulators and power supplies. This 30 megawatt transmitter for radar and component testing is typical. It demonstrates a unique capability for solving the special problems of superpower RF.

Two major design considerations in superpower RF equipment are performance *and* safety. In this unit—as in other Radiation-built systems with peak power to 100 megawatts and frequencies to 40,000 megacycles—special circuitry operates at miscrosecond speeds to prevent damage to the equipment. It includes five sub-assemblies with remote console containing all controls, interlock indicators and monitoring oscilloscope.

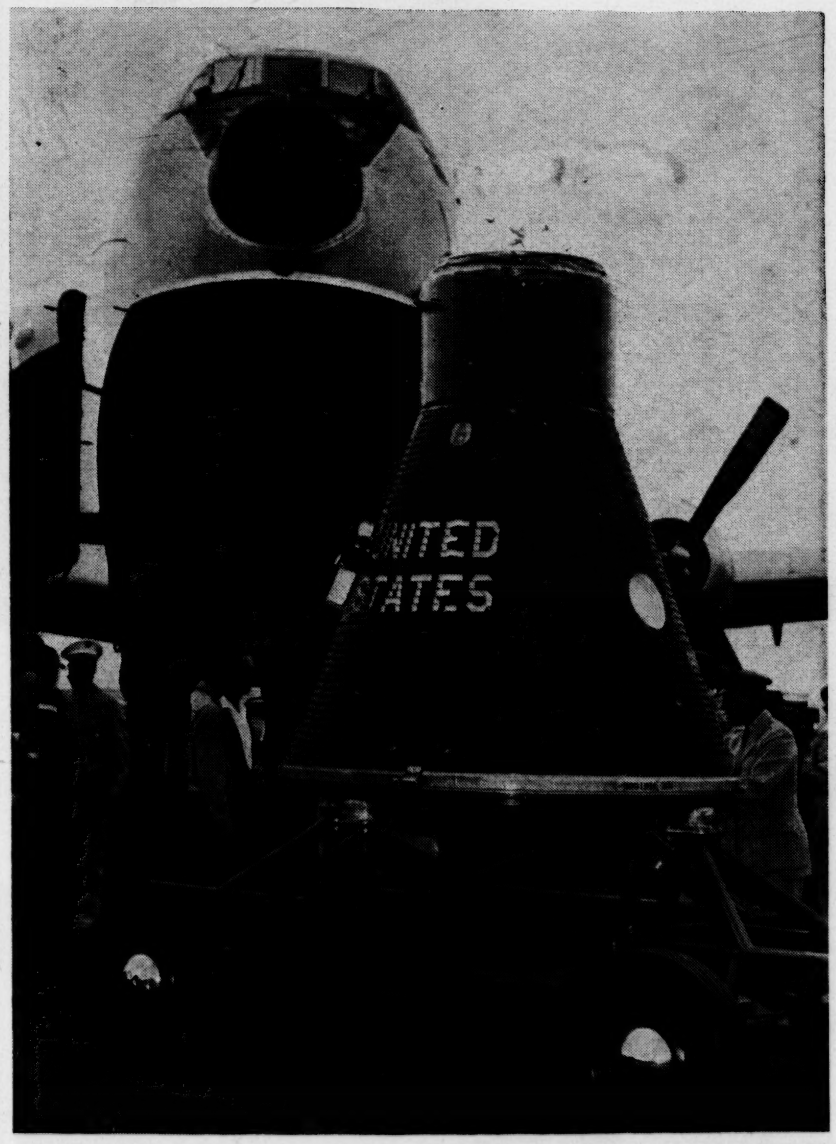
This capability of Radiation at Stanford is being utilized today by many prime contractors for advanced defense systems, and by makers of high-power commercial equipment. If you work with megawatts at megacycles, you can rely on it, too, for comprehensive solutions to your problems. Write Radiation at Stanford, Dept. AW-61, 3180 Hanover Street, Palo Alto, California, for detailed information.

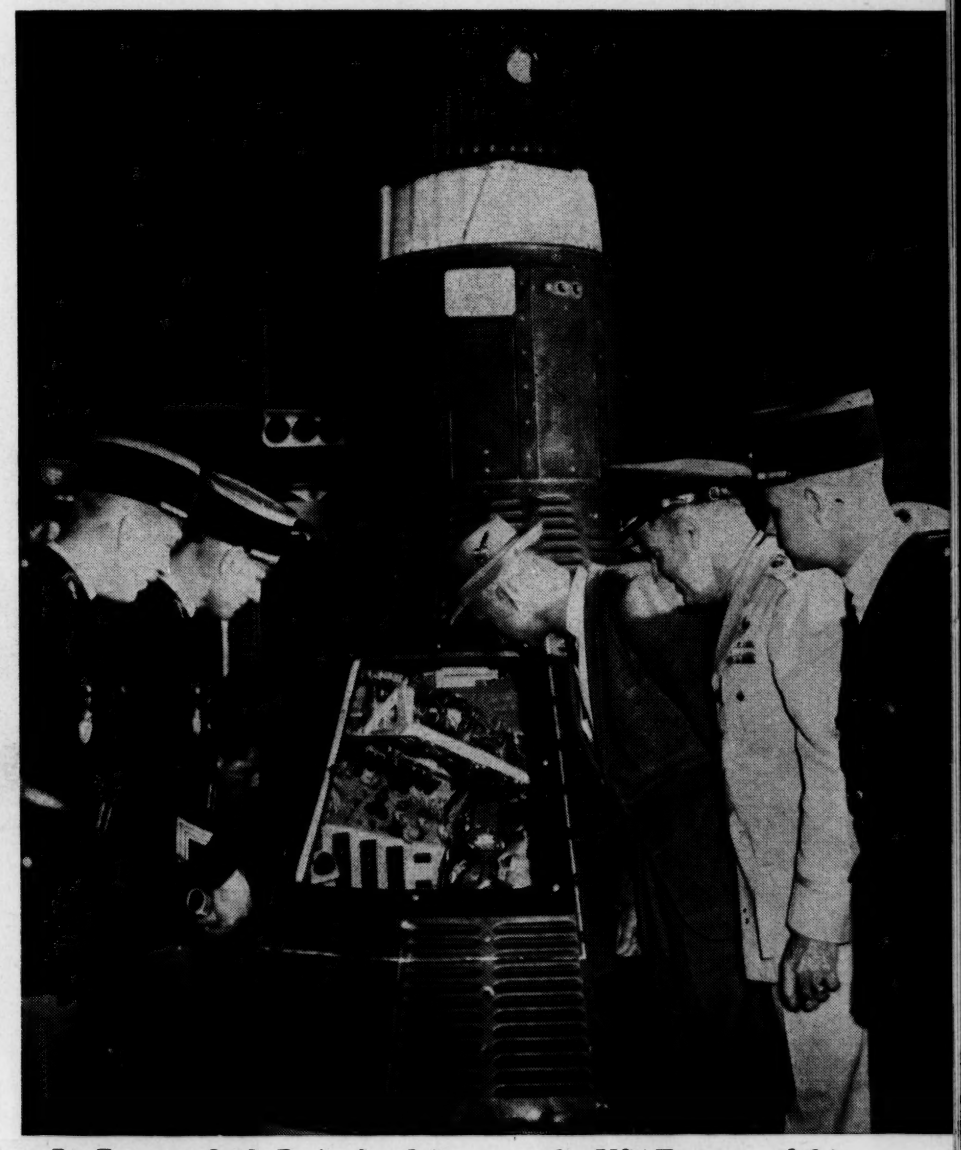
RADIATION
INCORPORATED



Visitors to the 24th International Air Show in Paris, France, gather for an opportunity to view the Project Mercury space capsule displayed alongside the U. S. Space Dome exhibit. Space capsule carried Cdr. Alan B. Shepard, Jr., American astronaut, to a non-orbital height of 117 mi. on May 5. Mercury ballistic flight was boosted by an 83-ft. 66,000-lb. Redstone vehicle.

French Throng to See Mercury Capsule at Show





Project Mercury space capsule (left) is unloaded from a USAF C-124 at Le Bourget field, Paris, for delivery to the USAF space exhibit at the air show. USAF Col. K. O. Dessert, Montgomery, Ala., commander U. S. Military Participation, 24th International Air Show (right) explains the mechanism of the space capsule to visitors. Capsule proved to be a big attraction at the show.

HOW MANY PLANES ARE THEY TALKING ABOUT?

"As a tactical strike aircraft in support of ground troops, it can whisk in with rockets, a 20mm cannon that fires at a rate of 6000 rounds per minute and a bomb bay packing a heavier load, either conventional or nuclear than a World War II B-17 bomber . . . . ." **Time**

"The plane . . . has the versatility to perform alternately as an interceptor, fighter or high-speed refueling plane . . . . ." **New York Times**

"The one-man bombers . . . can provide combat flexibility and observation capability . . . . . ." **Flying**

"In effect, a reusable guided missile . . . . . ." **Interavia**

ONE!

THE F-105 THUNDERCHIEF

. . . THE WORLD'S MOST POWERFUL ONE-MAN AIRCRAFT NOW IN SERVICE WITH THE U. S. AIR FORCE

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Inadequate Ion Systems Funding Scored

Los Angeles—United States' projected funding of ion propulsion systems must at least be doubled and perhaps tripled, if the Russian lead in this field is to be overcome, the recent joint meeting of the Institute of Aerospace Sciences and American Rocket Society was told by an electrical propulsion specialist.

Ernst Stuhlinger, of the National Aeronautics and Space Administration's Marshall Space Flight Center, said a minimum three-pronged effort is needed to provide:

- **Accelerated development** of a higher-power nuclear source than the presently anticipated 30-kw. Snap 8 generator, so that sufficiently large power supplies would be available to mate with ion engines in the years ahead. A .5- to 1-mw. supply, under 10 lb./kw., would be adequate for an ion propulsion system to carry payloads to any planet in the solar system.
- **Accelerated development** of a 60-kw. engine which would serve as a starting program.
- **Continued aggressive research** and development programs and, if specific application warrants it, construction of a 30-kw. arc jet engine.

Stuhlinger said that such an effort would necessitate an additional $6.8 million and raise the total Fiscal 1962 funding for electrical propulsion to about $15 or $20 million. For Fiscal 1963, the program would then run to between $25 and $35 million and $50 to $60 million a year in the Fiscal 1964 to 1966 years. Stuhlinger was joined in his remarks by Capt. Richard J. Hayes, a USAF officer on loan to NASA to coordinate ion propulsion programs.

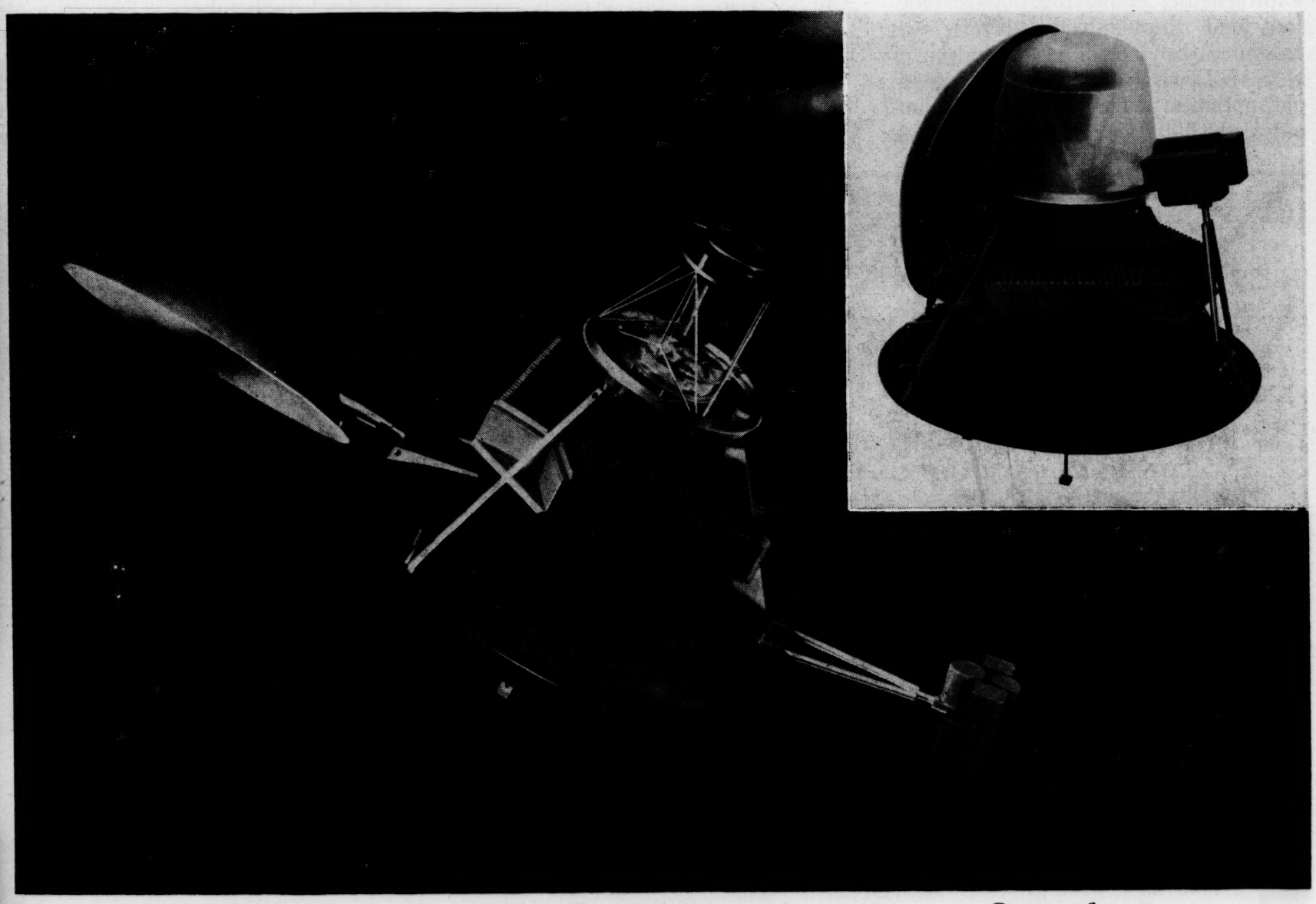
Current funds, the two engineers pointed out, do not permit any ion engine supporting work—as distinct from engine development proper—and are barely adequate to permit flight of the Hughes Aircraft Co. ion engine in a Scout vehicle, as planned for October, 1962.

In other IAS/ARS sessions, S. C. Morrison, of Space Technology Laboratories, made the unorthodox suggestion that "brute force" methods may be a way of achieving reliability in space programs.

High Cost Cited

As an example, he suggested that a salvo of identical-mission space probes might be desirable if launch opportunities—such as the relative positions of Venus and earth—occur infrequently. Morrison conceded the high costs of a "brute force" approach but said that they might be justified in the case of one-shot missions and that the firing of two probes, each with a reliability of 0.9, would increase the chance of at least one success to 0.99, if both were truly independent.

Further, he suggested an increase in



Mars Flyby Satellite Could Drop Instrument Capsule

Recently-completed design study by the Jet Propulsion Laboratory of a Mars flyby spacecraft envisions a jettisonable, instrumented capsule which would be fired along a steep re-entry angle to the planet from a distance of about 320,000 km. Trajectory and point-of-impact would be so selected that planet's rotation would maintain line-of-sight communication between capsule and craft. Parachute-lowered capsule would transmit data back to the spacecraft, which—coming within 8,000 km. of Mars before passing on to deep space—would then relay the information back to earth. Total flyby time for data relay is estimated at 13 hr. Spacecraft, (model in insert with antenna and boom-carrying instruments folded for launch) would weigh 1,450 lb. and could be lifted by an Atlas-Centaur.

design margins and greater derating of components to improve reliability. The attendant extensive redundancy and additional weight, he felt, would be justified if the mission succeeded.

Also reported at the meeting were:

• **Radiation-cooled arc jet** engine, described by R. R. John, Avco Research and Advanced Development Division, Wilmington, Mass. The engine, employing either ammonia or hydrogen as a working fluid, has operated continuously up to 100 hr. and eliminates the need for a closed-cycle cooling loop. John said that a specific impulse of 1,000 sec. is possible with the engine using ammonia.

• **High-efficiency cesium ion** engine, built by Electro-Optical Systems, Inc., has produced up to three millipounds of thrust and has operated continuously in a vacuum chamber for 175 hr. The 61-beam engine, described by M. P. Ernstene of the company, can produce specific impulses of 5,000 to 8,000 sec. and efficiencies up to 65%. Company hopes to reduce current power to thrust ratio of 280 kw./lb.

• **Ion engine,** employing porous tungsten and through-feed ionizers, was presented by Ronald J. Cybulski of NASA's Lewis Research Center. Sample optimum data were: specific impulse, 11,000 sec.; ionizer potential, 8 kv.; current density, 88 amp./m²; accelerator and power efficiencies of 97.3 and 41.9% respectively. In another set, figures were: 12,900 sec.; 11 kv.; 36.5 amp./m²; 92 and 35.5%.

• **Plasmajet thrustor,** described by Paul S. Masser, Plasmadyne Corp. A hot wall thrustor design equaled or exceeded theoretical frozen flow efficiencies and a specific impulse of 1,000 sec. can be achieved using hydrogen in the thrustor.

PRODUCTION BRIEFING

Burton Mfg. Co., Santa Monica, Calif., will build calibration equipment for pitot-static systems for the Air Force under $250,000 contract. The portable unit permits one-man calibration of flight instruments, air data computers and flight recorders.

Sanders Associates has a $2,146,989 Navy contract for anti-submarine warfare aircraft sonobuoys.

Pratt & Whitney has a $36.6-million Navy contract for continued production of J57 series turbojets, with $21.4-million of the contract for Air Force engines.

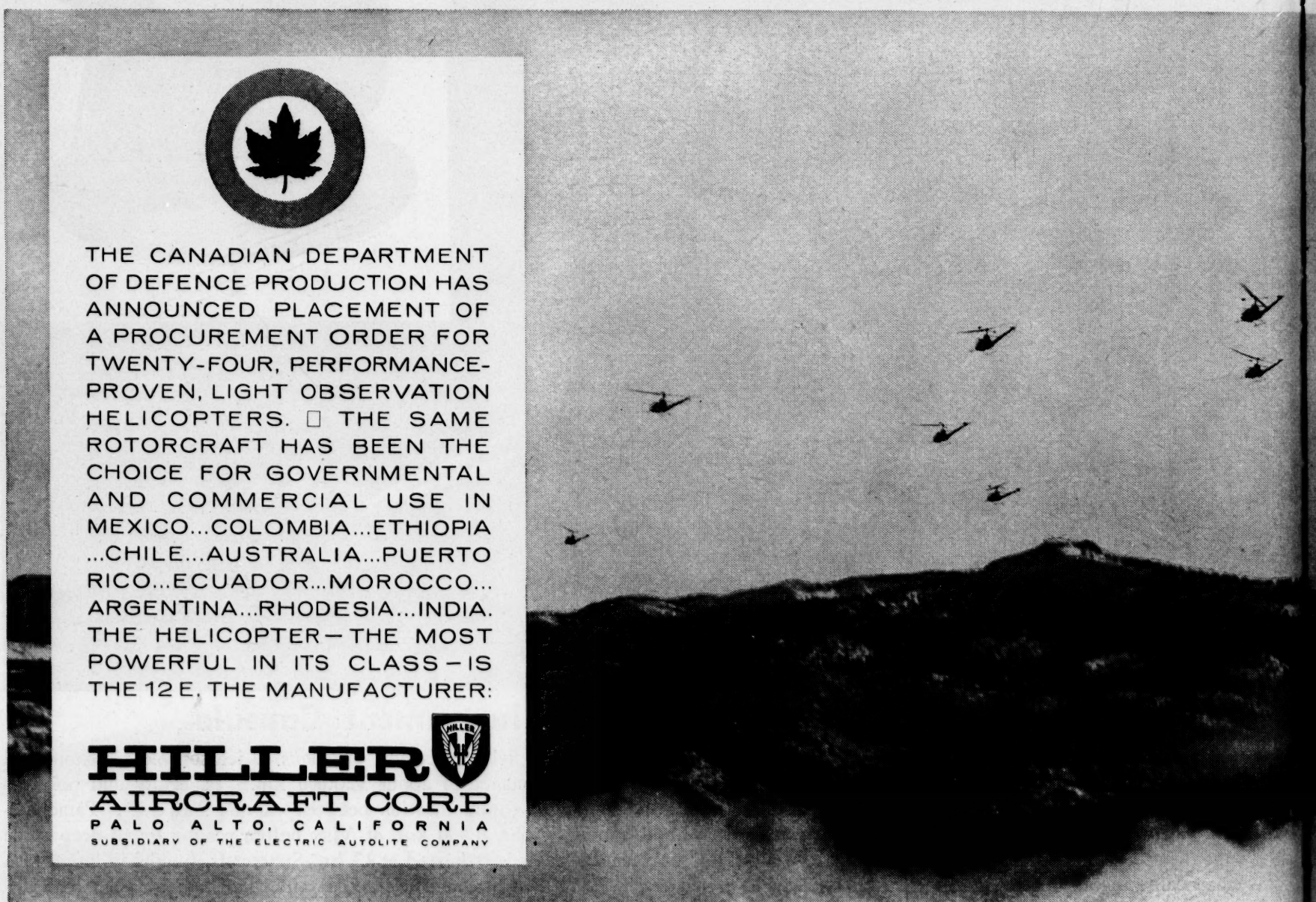
Atlantic Research Corp. has a $346,000 contract from Air Force Flight Test Center for solid propellant research.

General Electric Co.'s Flight Propulsion Division has received subcontracts from Thiokol Corp. for manufacture of first-stage Minuteman solid-propellant casings. Contract has value approximating $9 million, will run through 1962.

Model Engineering and Mfg. Corp., Huntington, Ind., will supply guidance and electronic components for the Bullpup air-to-surface missile and the Sparrow air-to-air missile. The company will provide 200 spring gyros for Bullpup guidance system produced by the Maxson Electronics Corp. (AW June 19, p. 31). Microwave antenna components will be supplied for the Sparrow missile guidance under contract from Raytheon, Sparrow prime contractor.

Bendix Corp.'s Scintilla Division, Sidney, N. Y., will produce umbilical type electrical connectors for the Polaris missile launch tubes under $900,000 contract from General Dynamics' Electric Boat Division. The electrical connectors join the missile control center of the submarine and the missiles inside the launch tubes.

Garrett Corp.'s AiResearch Manufacturing Division, Phoenix, Ariz., will build engine starters for the North American Hound Dog air-to-surface



missile under $1.3-million contract. Both dual solid propellant-pneumatic starters and pneumatic probe starters are included in the contracts.

Hamilton-Standard Division of United Aircraft Corp., Windsor Locks, Conn., will continue production of Boeing B-52H bomber air-conditioning equipment under $600,000 contract. The reorder from Boeing is for the plane's cabin air conditioning packs.

Bendix Corp., Ann Arbor, Mich., has received a $670,000 contract from the Navy Bureau of Ships to develop a shipboard communications terminal for the Advent communications satellite program.

Air Force has awarded General Electric's Missile and Space Vehicle Department a $13-million contract for installation and servicing of re-entry vehicle equipment at nine Atlas bases.

Thiokol Chemical Corp. and a French company, Societe d'Etude de la Propulsion par Reaction, have entered into a reciprocal sales arrangement for the marketing of solid propellant motors in the U. S. and France.

University of Michigan has been awarded a $270,000 contract from National Aeronautics and Space Administration for high-altitude radiation measurements, to be made by balloon-lifted instruments.

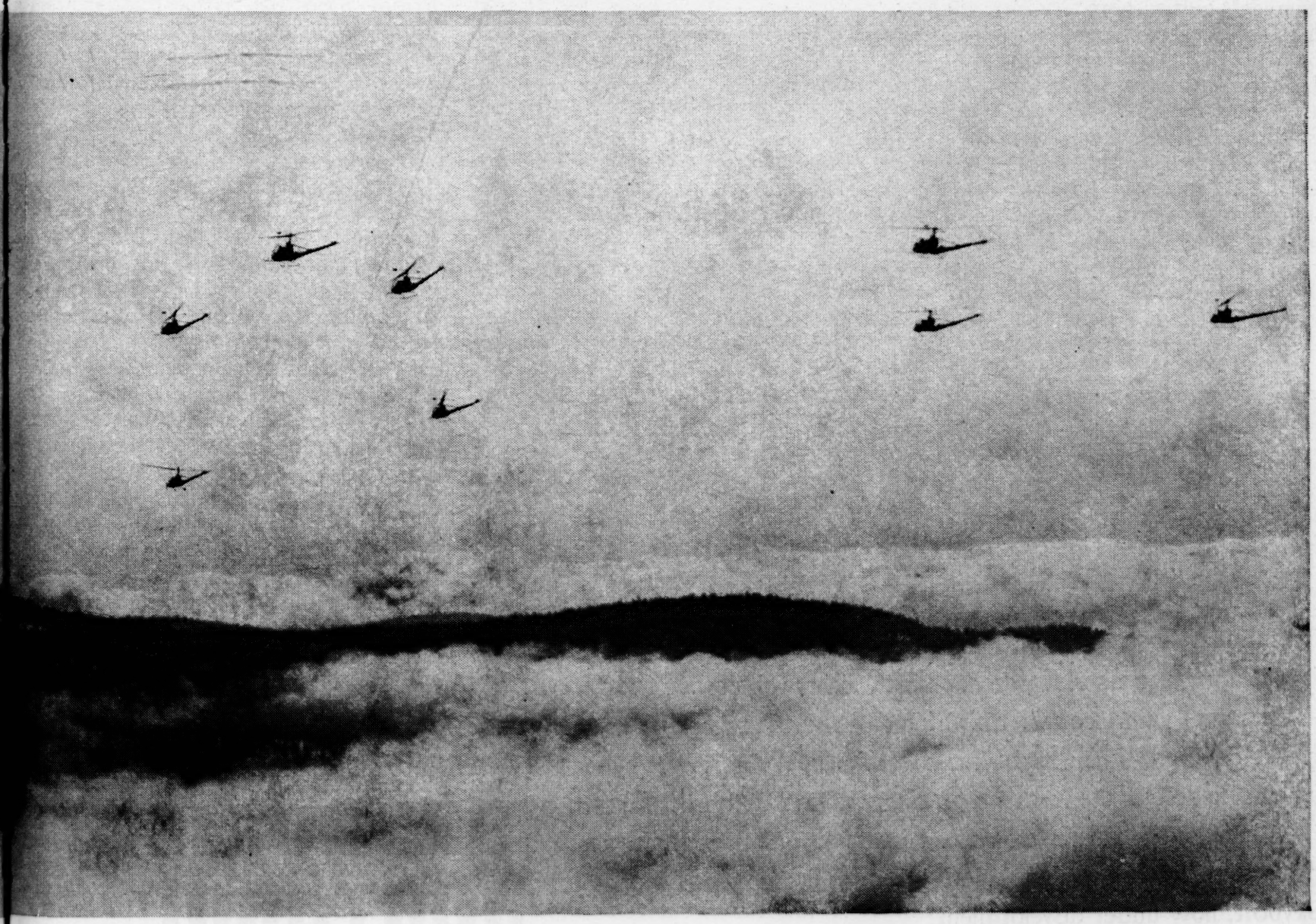
Menasco Mfg. Co., Burbank, Calif., will supply Douglas Aircraft Co. with titanium alloy pressure vessels for the NASA Saturn S-IV rocket. Burst tests already have been conducted by Douglas at its Sacramento facility on the Menasco vessel submerged in liquid hydrogen at −423F.

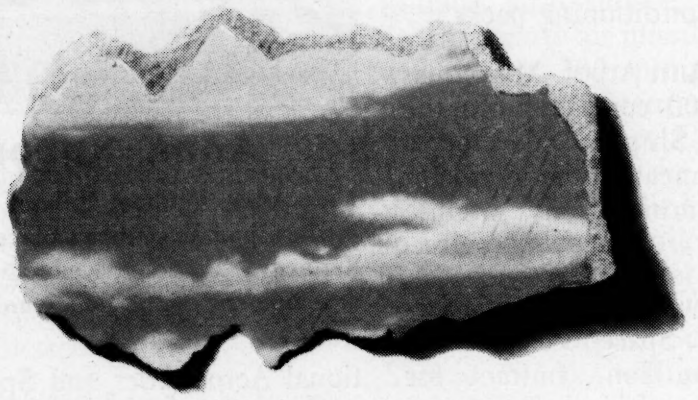
Wilmot Castle Co., Rochester, N. Y., will study various methods of sterilizing equipment aboard deep space probes under the terms of a $106,000 National Aeronautics and Space Administration contract.

Daystrom, Inc.'s Pacific Division has received a $100,000 follow-on order for flight control stability reference gyroscopes for the USAF GAM-77 (Hound Dog) air-to-surface missile from Autonetics Div. of North American Aviation.

Adm. Raborn Is Awarded Collier Trophy

Vice Adm. William Raborn, Jr., Navy director of special projects, seated beside his wife in the Chief Executive's office, admires the Robert J. Collier trophy with President John F. Kennedy. President Kennedy awarded the trophy to Adm. Raborn for his direction in the development of the Polaris missile weapon system (AW May 22, p. 33).





Problem for Skybolt: Where is this patch of sky?

To calculate its trajectory to target, Skybolt air-launched ballistic missile will have to know precisely where it is at any given moment, day or night. This problem is neatly solved by the star tracking capability of its Astronertial guidance system, which can provide an instantaneous fix on any piece of sky the mother plane passes through. When Skybolt is operational, the guidance system will put it into a ballistic trajectory after launch, to deliver the warhead on target up to 1000 miles away.

This versatile stellar-monitored inertial guidance system is being designed and built by Nortronics for the USAF-Douglas Skybolt, now under development.

NORTRONICS
A DIVISION OF
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Put complete responsibility for your radome and antenna test systems in our hands . . . free your valuable engineering time for other productive work. We can write the complete specifications . . . propose test programs . . . design and build an integrated test facility — in whole or in part . . . and guarantee the performance of the finished system.

Dunn test systems provide:

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- **radome attenuation measurement**
- **antenna gain measurement**
- **antenna pattern null location**
- **parabolic dish ellipticity measurement**
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Dunn makes available high-speed, automatic production checkout systems to ultra-high-accuracy, manually-operated tests, with flexibility for lab use. Dunn reduces costs, increases reliability and speeds delivery through use of standard test instruments wherever possible.

Write for data sheet . . . Dunn Engineering Corporation,
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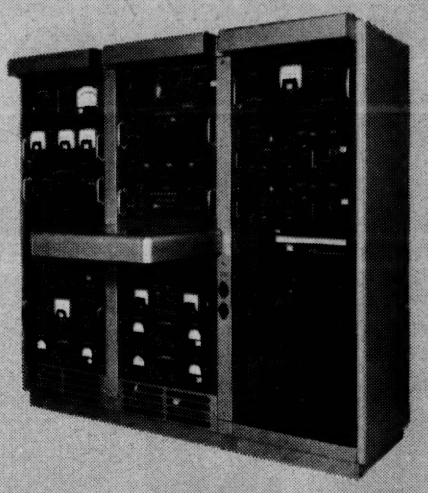
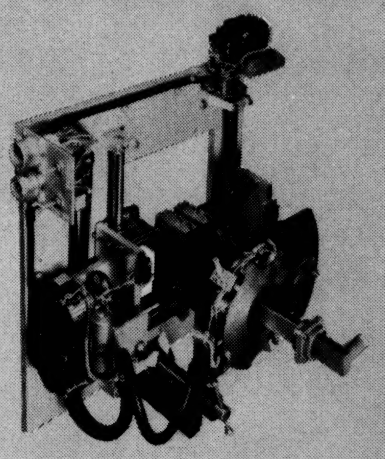
- radar test systems
- advanced electronic systems
- inertial products
- test facilities engineering

COMPONENTS OF A

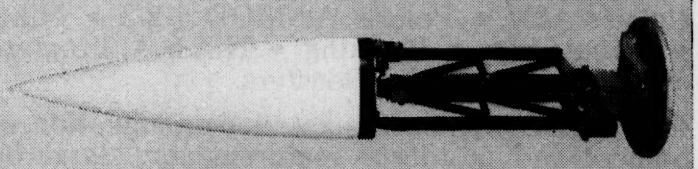
TYPICAL TEST SYSTEM



Central Control Console . . . for high-accuracy measurement of the characteristics of radomes of intermediate sizes . . . this unit can sequence test operations either manually or automatically.



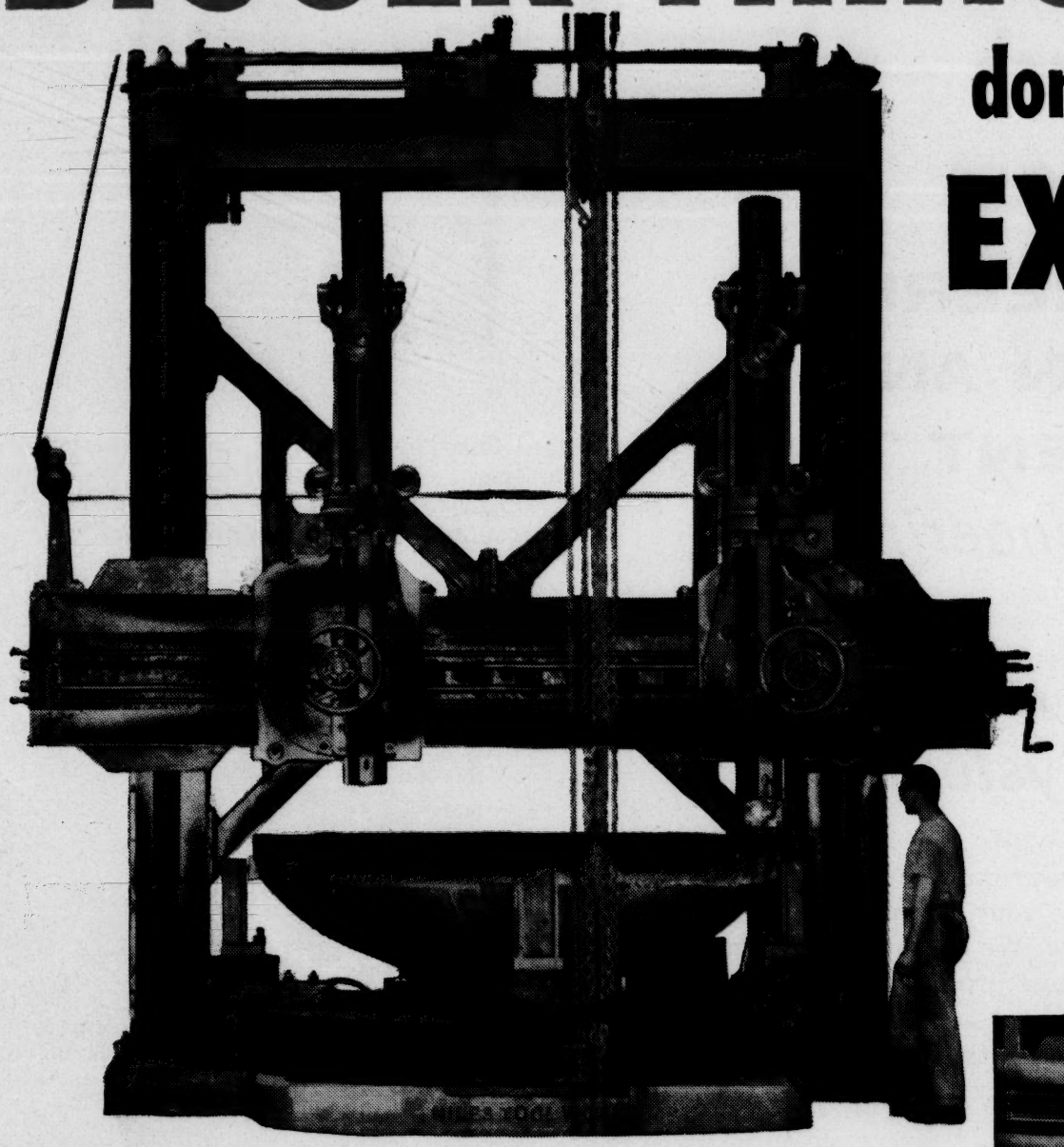
Illuminating Horn . . . automatically remotely controlled by the test console. A Geneva drive rotates the horn through prescribed angles for polarization changes.



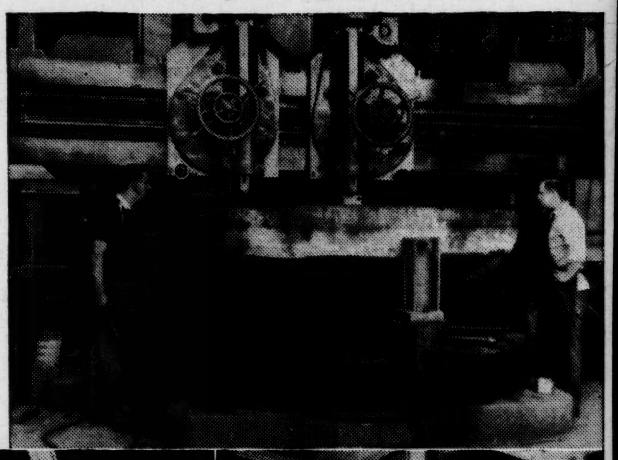
Radome Holding Fixture . . . designed by Dunn to be almost entirely in the r-f shadow of the dish, minimizing fixture coupling, reflection, and back-scattering.

Master Microwave Source . . . provides pulsed microwave signals simultaneously at three different frequencies to a maximum of three radome test stations. Unit may be switched and controlled locally for test and adjustment.

BIGGER THINGS are being done at EXCELCO



Machining 120" Big Booster Heads



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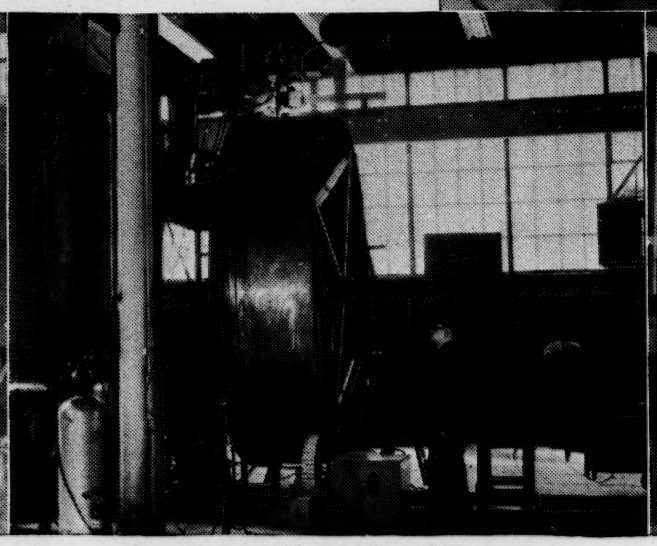
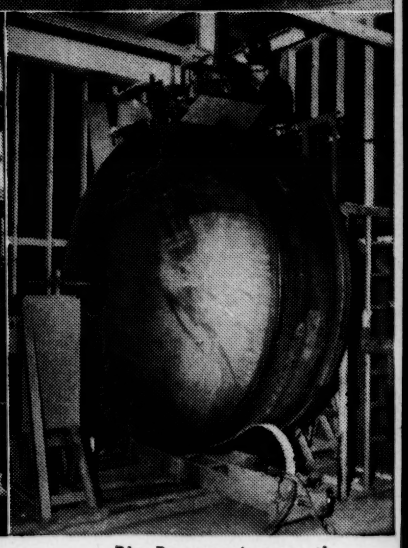


Special Automatic Welding of Big Booster Head Assemblies



Big Booster Automatic Welding

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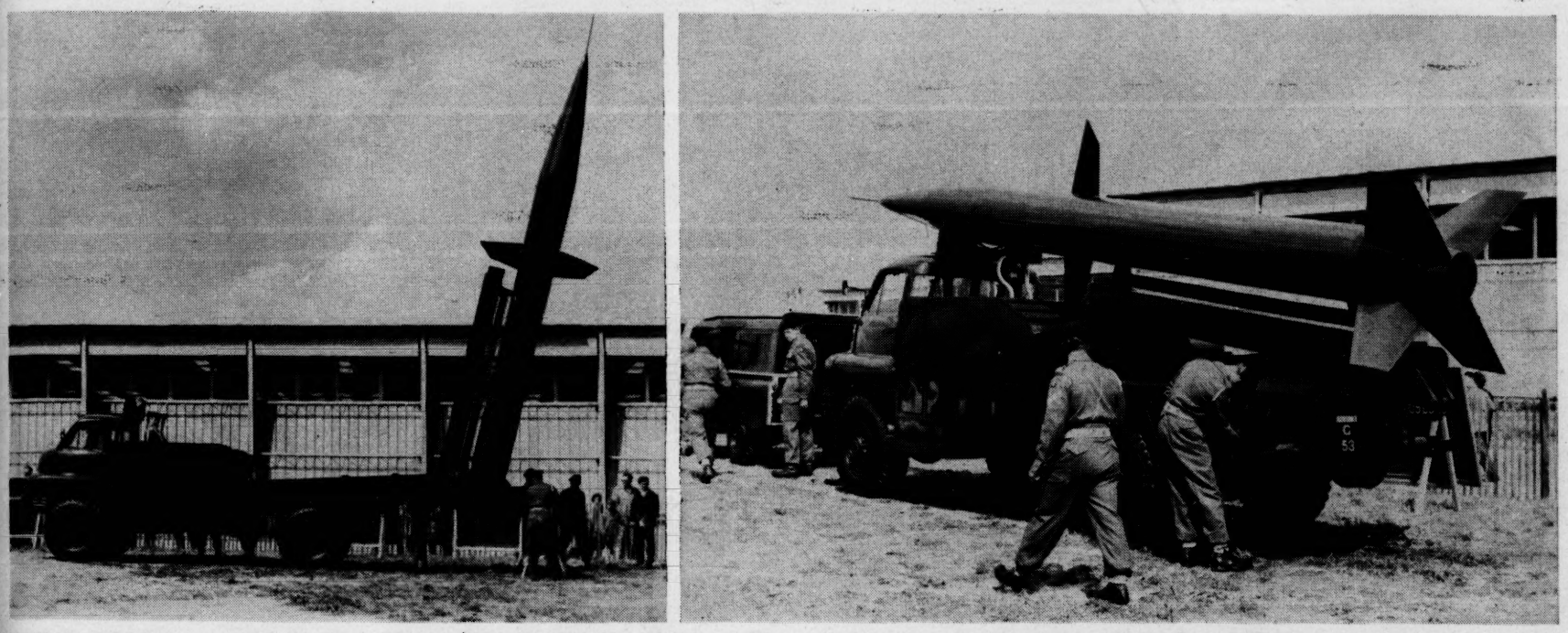


ONLY vehicles required at Blue Water launch site are the launcher-transporter and a long-wheelbase Land Rover.

Blue Water Displays Launch Mobility

Paris—Britain's Blue Water Army tactical missile incorporates the necessary checkout system and sequences in internal stores, making it possible to launch the unit by means of a simple cable-connected firing switch.

In the firing sequence after the launcher-transporter has been moved into position, the switch is trailed out to a distance of approximately 50 yards, with the two-man launch crew shifting to a point slightly above a straight line with the Blue Water to avoid flying rocks and other debris that streams out at a 90-deg. angle at blast-off.

One flick of the switch, by the officer in command or senior non-commissioned officer, transmits an electrical impulse to the missile that initiates its internal power supply package. At the same time, the erector begins to raise the missile to launch position, and the final checkout automatically begins, with a series of red and green lights on the base box of the firing switch flashing on and off to keep the operator informed of its progress.

Once in firing position, and with all lights on green, the missile is launched by a second activation of the switch.

English Electric, developer of the solid-propellant Blue Water system, originally considered a unit in which one operation of the switch would be sufficient to carry the sequence throughout the checkout phase and one through actual launch. The idea was abandoned, however, because of the complexity of the system that would have been required and because of the danger that an errant impulse might result in a launch before the inertially-guided Blue Water was in its full firing position.

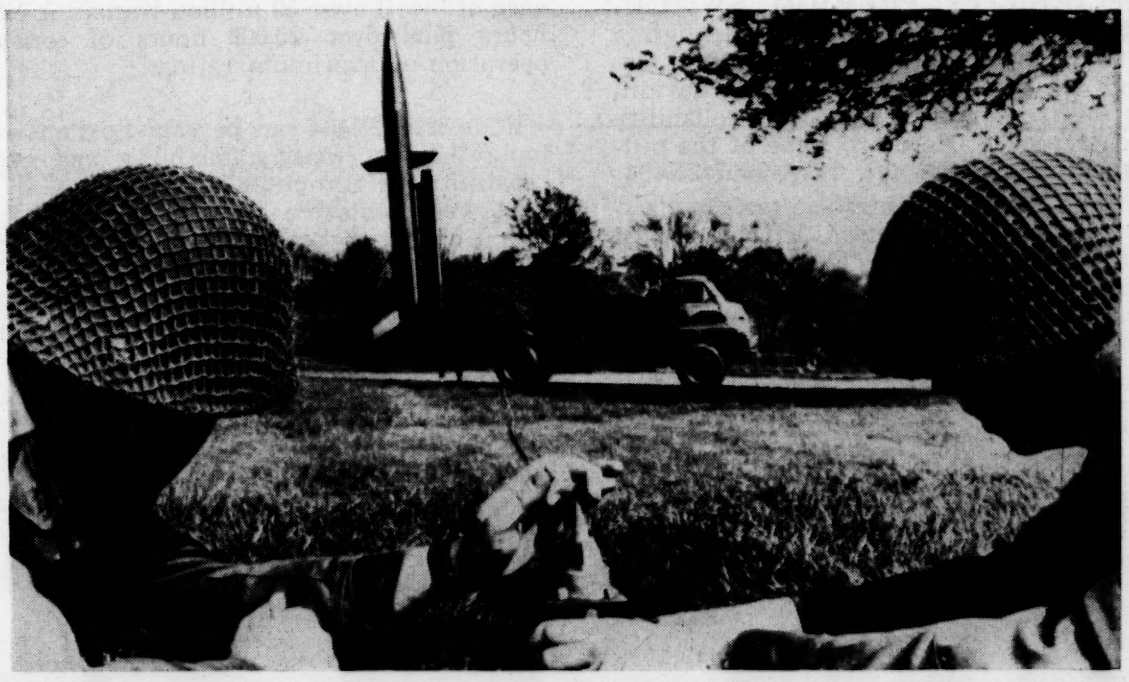
Aside from the regularly-scheduled research and development launches, Blue Water has been fired more than 20 times in specific tests of the durability of its launcher-transporter unit. The same launcher-transporter has been used in all firings.

Some paint has been sheared away by sand blast in the rear launch area, and the color of the tires has been dulled somewhat by the blast effect and flying debris from the ground. Otherwise, according to an official connected with the project, the launcher-transporter is in good condition and fully operational.

Blue Water, which the British would like to sell to North Atlantic Treaty Organization members as a replacement for the obsolescing 15-mi.-range Corporal, was put on public display for the first time at the 24th Paris International Air Show at Le Bourget Airport. While its range has not been officially disclosed, it is believed to be comparable to the 85 naut. mi. of the U. S. Sergeant.

British spokesmen say the Blue Water can be fired within 10 min. after it has moved from its camouflaged holding position to a previously-surveyed launch site. Only vehicles required at the site are the launcher-transporter mounted on a standard three-ton chassis and a long-wheelbase Land Rover carrying a ground computer that feeds final target data into the inertial-guidance unit immediately prior to the launch countdown.

After firing, the spokesmen say, the launcher-transporter can be on its way again within two minutes.



SWITCH in foreground initiates automatic pre-launch of Blue Water missile.

RCA PREMIUM QUALITY COMES FROM WITHIN...

RCA establishes a new level of reliability for computer transistors with the 3907/2N404, produced under RCA's CERTIFIED-RELIABILITY PREMIUM SWITCHING-TRANSISTOR PROGRAM

Now from RCA, originator of the famous 2N404, comes a significant improvement in reliability—RCA 3907/2N404—the first of a series of transistors produced under RCA's CERTIFIED-RELIABILITY PREMIUM SWITCHING-TRANSISTOR PROGRAM. Through a unique ungrounded four-poster structural design and new double-weld construction, superior built-in ruggedness and reliability have been achieved. Here are some of the outstanding features of the new RCA 3907/2N404:

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- *Thermal resistance of .400°C/W*
- *Exceeds MIL environmental specifications for shock, vibration, salt spray, centrifuge and moisture resistance.*

And this new 3907/2N404 incorporates all of the superior characteristics of the original RCA 2N404, long the workhorse of the computer industry. This famous unit is built on the experience of: well over 50 million transistor life-test hours plus over 20,000 hours of continuous operation at maximum ratings.

RCA 3907/2N404 can be your best answer for top reliability, mass availability and superior capability in computer transistors. Call your RCA representative for complete particulars. For information on RCA's PREMIUM TRANSISTOR PROGRAM, write RCA Semiconductor and Materials Division, Commercial Engineering, Section F-112-NN, Somerville, New Jersey.

SWITCHING SERVICE Maximum Ratings, Absolute Maximum Values 3907/2N404	
COLLECTOR-TO-BASE-VOLTAGE	−25 MAX
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COLLECTOR CURRENT	−200 MAX
EMITTER CURRENT	200 MAX
TRANSISTOR DISSIPATION: At ambient temperature of: 25°C 55°C 71°C	 150 MAX 75 MAX 35 MAX
AMBIENT TEMPERATURE RANGE: Operating Storage	 −65 to + 85°C −65 to + 100°C
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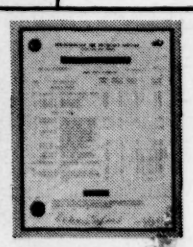

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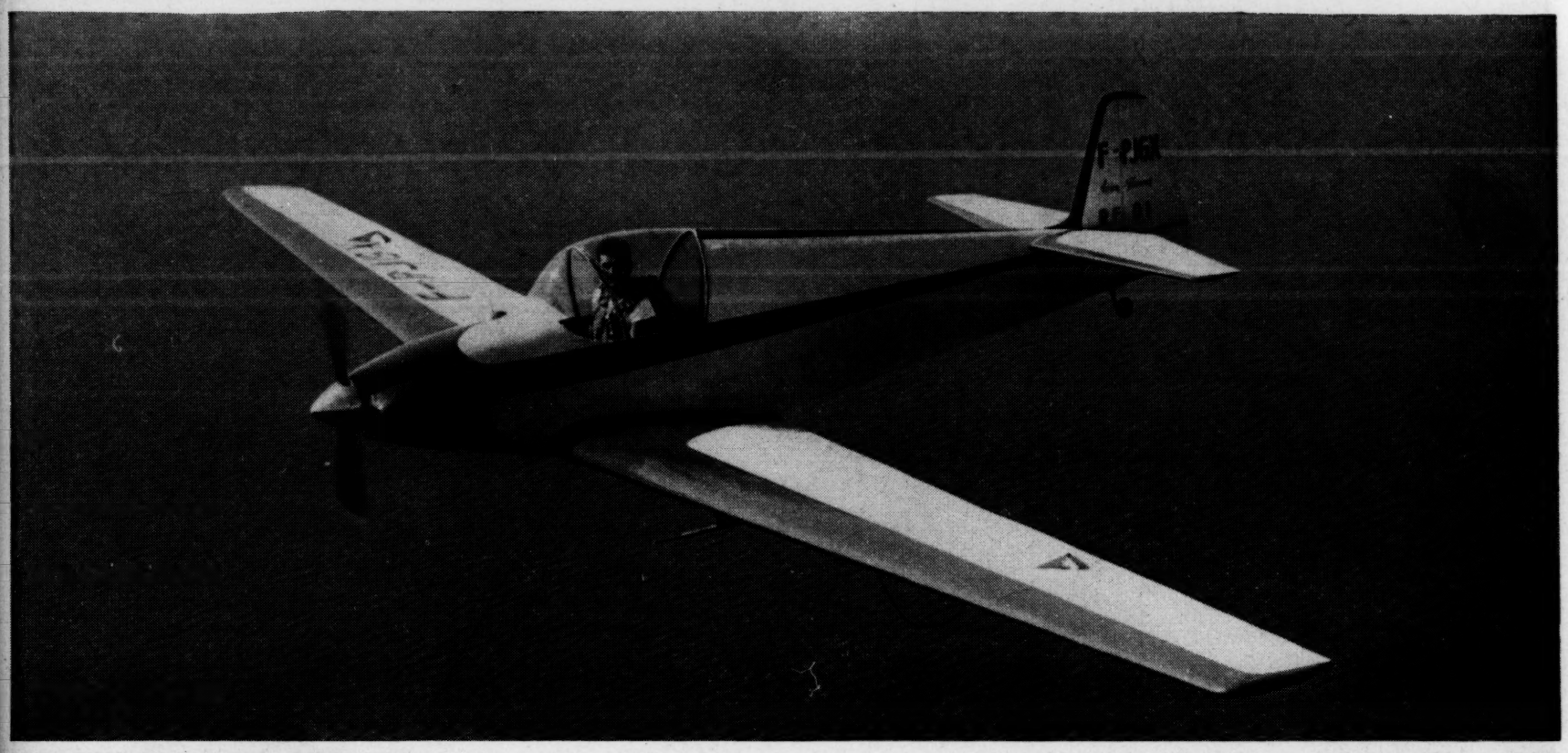


PROTOTYPE of French RF-01 glider is powered by 25-hp. Volkswagen engine; production models will be equipped with 35-hp. VW engines. Other modifications in the production version will include a lighter airframe and the addition of flaps.

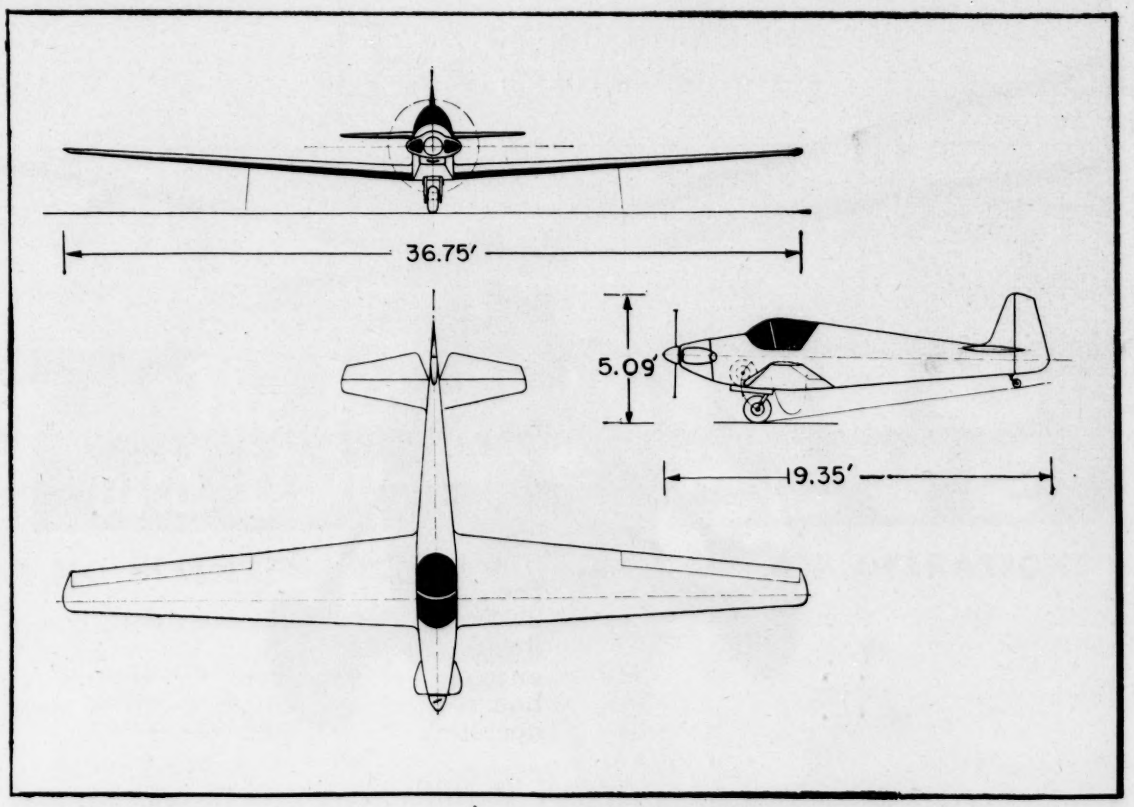
Volkswagen Engine Powers French Glider

Cannes—French RF-01 powered glider is scheduled to go into production by late this year following international certification and extensive prototype tests.

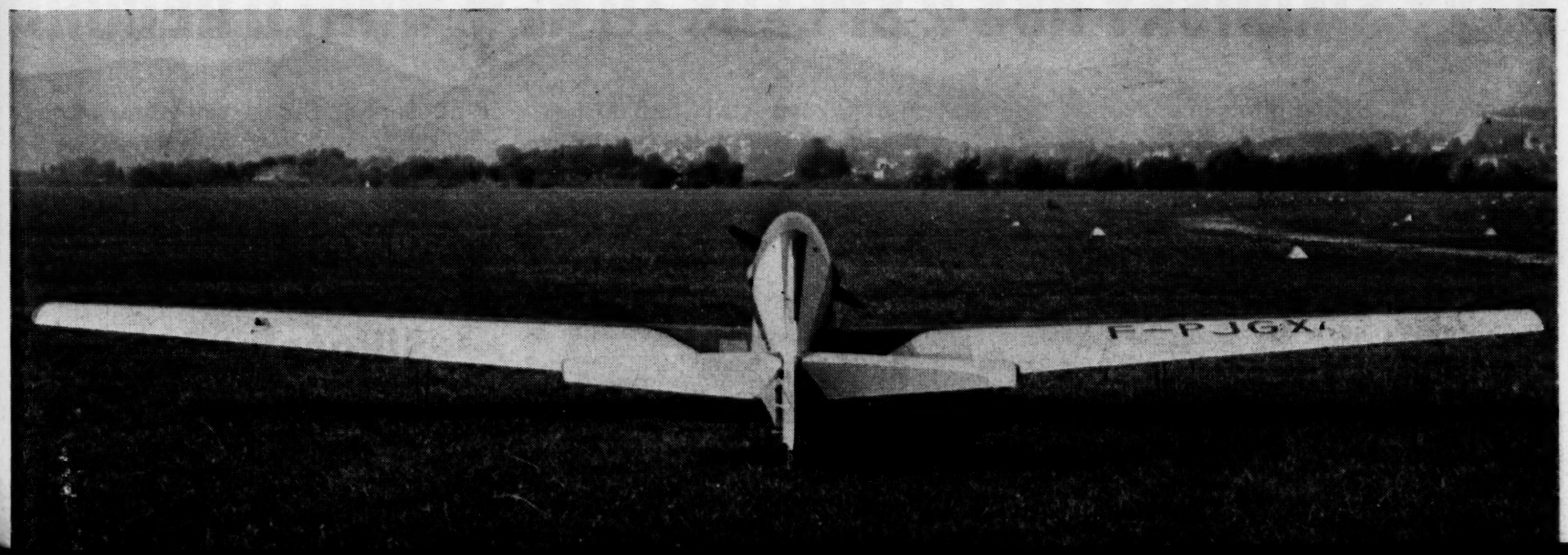
Privately designed by Rene Fournier, of St. Avertin near Cannes, certification of the RF-01 is being sponsored by the French Air Ministry. The prototype recently completed its four-month flight test program, and production versions are scheduled to be produced by Centre-Est Aeronautique S. A. R. L. in Dijon.

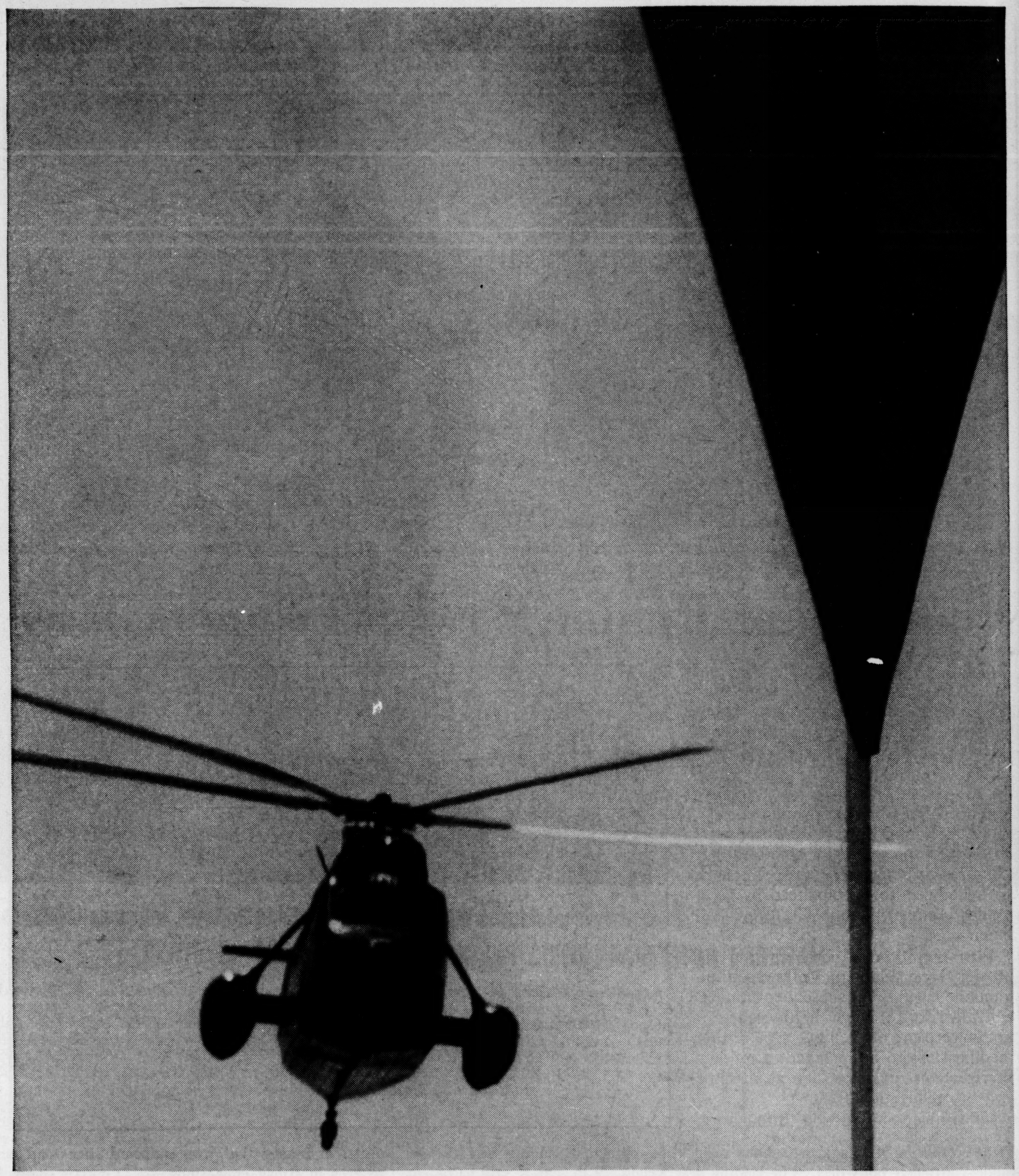
First prototype is powered by a 25-hp. 1,131 c.c. German Volkswagen automobile engine, but subsequent models will incorporate a new lightweight 35-hp. powerplant of the same type. Other modifications to be included in production versions include a lighter airframe and the addition of flaps.

Of simple construction throughout,



THREE-VIEW of RF-01 (above) shows main wheel retraction; landing gear (below) consists of main wheel, two outboard struts and a rudder-controlled tail wheel. The landing gear weighs 29 lb. but is said to be effective even in strong cross-winds.





NAVY-SIKORSKY HSS-2 SPEEDS TO NEW WORLD RECORD

Last month, U.S. Navy pilots in a Sikorsky HSS-2 crossed the finish marker on a three-kilometer straight line course to set a new world helicopter speed record. The speed: 192.9 miles an hour—25.8 miles an hour faster than the previous record set by a Russian Mil-6 over a 100-kilometer closed circuit in 1959. This was the first official speed test of the new generation of Sikorsky twin-turbine helicopters. The boat-hulled HSS-2, which flew in its standard configuration, soon goes into fleet service as a key weapon in the nation's anti-submarine warfare defenses. It is the world's most advanced helicopter weapons system—and now the world's fastest helicopter as well. In a few months its commercial version, the 28-passenger S-61L, will enter service with Los Angeles Airways and Chicago Helicopter Airways. The record-breaking performance by the Navy-Sikorsky HSS-2 provides an unscheduled highlight for the 50th anniversary of Naval Aviation being celebrated this year.

Sikorsky Aircraft

Division of UNITED AIRCRAFT CORPORATION, Stratford, Connecticut

RF-01 Specifications

(Production Version)

Dimensions:

Span	36.75 ft.
Length	19.35 ft.
Height	5.09 ft.
Aspect ratio	11
Wing area	118.58 sq. ft.
Wing thickness-chord ratio	18

Weights:

Empty weight	265 lb.
Useful load	463 lb.
Gross weight	728 lb.
Wing loading	5.7-6.7 psf.
Load factor	10

Performance:

Cruising speed	108.7-111.8 mph. (2.4 gal.)
Minimum speed	55.8 mph. (1.6 gal.)
Rate of climb	689 fpm.
Rate of descent at zero angle	4.27 fps.
Rate of descent, flaps down	19.69 fps.
Landing speed	40 mph.
Takeoff distance	328 ft.
Service ceiling	19,680 ft.
Range	600-plus mi.

Powerplant:

One 35-hp. German Volkswagen engine.

the single-cantilever wings of the RF-01 are made of laminated wood and covered with fabric.

The landing gear consists of a single retractable main wheel located under the forward fuselage section and two steel struts attached to the center section of each wing. A small tail wheel controlled by the rudder bar enables directional control to be maintained when taxiing.

The landing gear weighs only 29 lb., but is effective even in a strong crosswind, according to Fournier.

Fuel Consumption

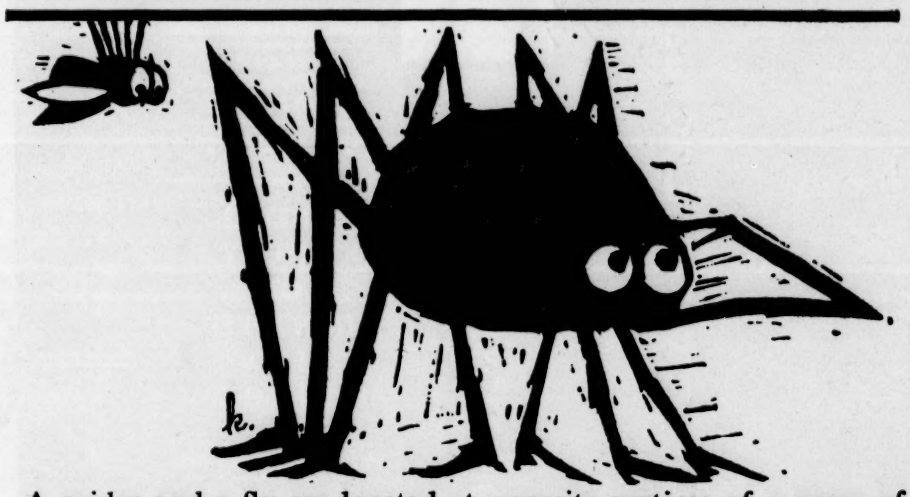
Low-power flight of the RF-01 prototype is economical. With reduced throttle, altitude can safely be maintained at 55.8 mph., with a fuel consumption rate of less than 1.1 gph.

For cross-country touring, the aircraft cruises at approximately 93.2 mph. at normal power output of not more than 24 hp. Fuel consumption at this speed is about 1.7 gph.

Low wing loading, a wing thickness-chord ratio of 17 (production model will be 18) and a rate of descent of less than 4.94 fps. also make the current RF-01 suitable for training in gliding.

The relatively large wing span does not inhibit the aircraft's maneuverability, and its 25-hp. powerplant provides sufficient power reserve for basic acrobatics, which also can be performed when the engine is cut out.

PROBLEMATICAL RECREATIONS 72



A spider and a fly are located at opposite vertices of a room of dimensions 1, 2 and 3 units. Assuming that the fly is too terrified to move, find the minimum distance the spider must crawl to reach the fly.

—Contributed

The new terminal headers coming up from our USECO Division add a modicum of additional reliability to transformers, electrolytic capacitors, plug-in type modules, tube sockets, can type delay lines, and filter networks. They're molded from an improved low-loss mineral-filled phenolic. High insulation quality. Don't resist the urge to write for further information: U.S. Engineering Co., 13536 Saticoy St., Van Nuys, California.

ANSWER TO LAST WEEK'S PROBLEM: 4 x 1,738 = 6,952; 4 x 1,963 = 7,852.

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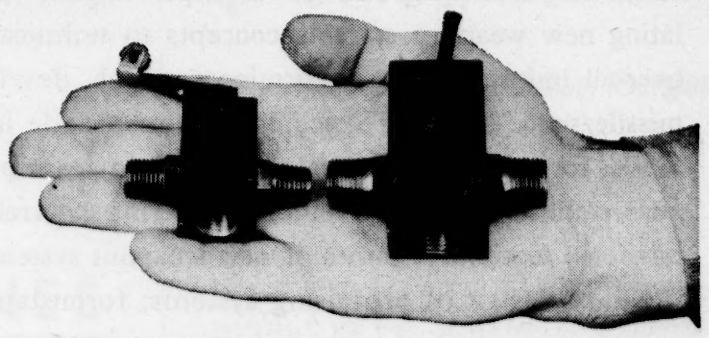

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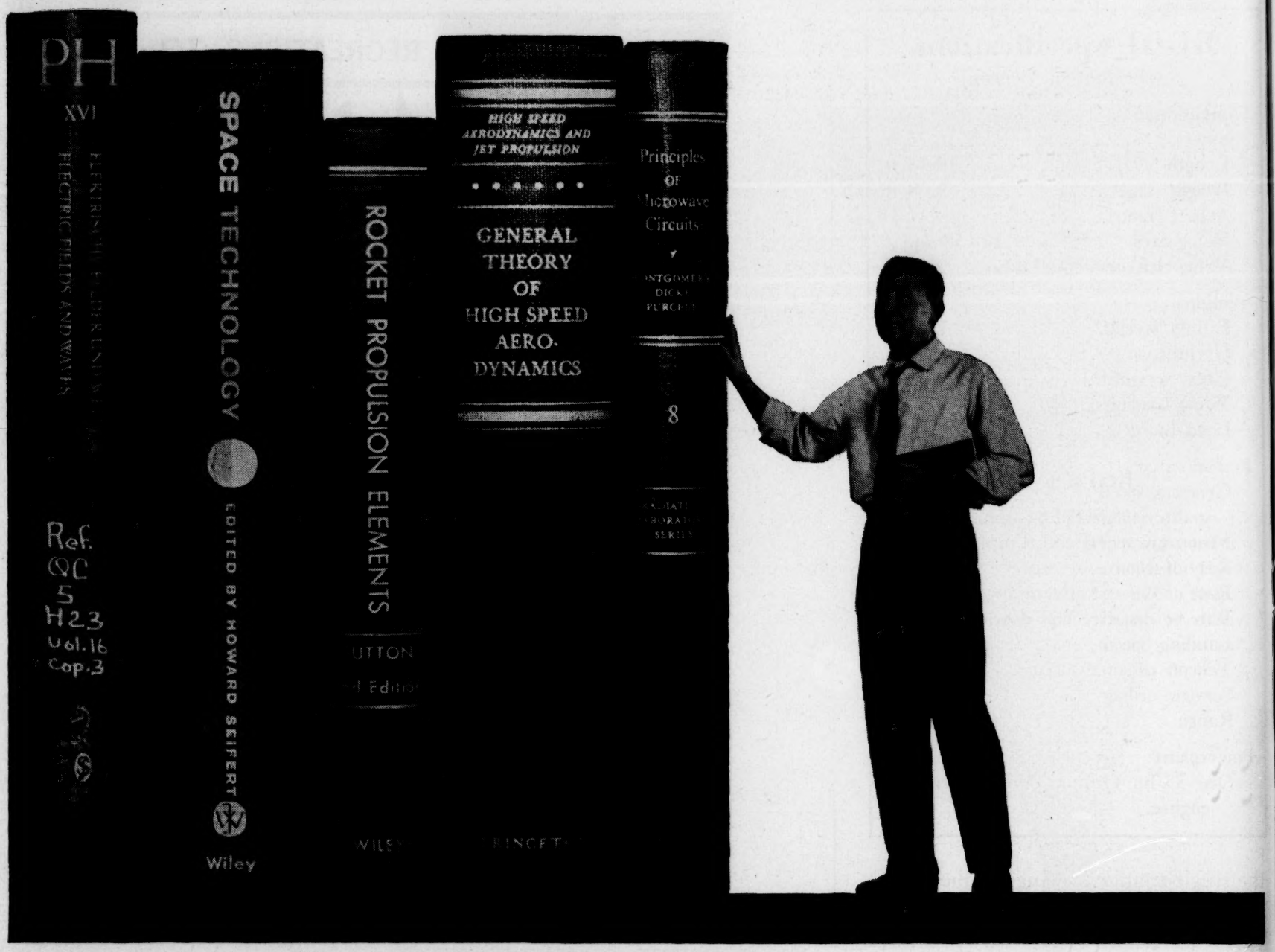

space systems planning and engineering in a unique role

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Organized in the public interest and dedicated to providing objective leadership in the advancement and application of space science and technology for the United States Government.

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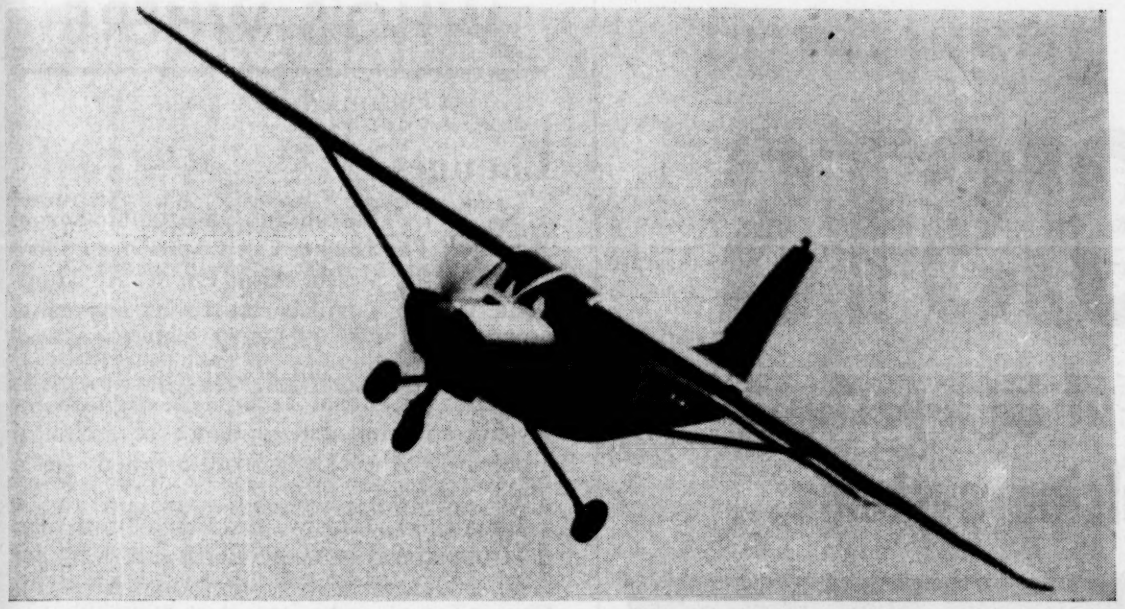

Italy's Santa Maria Makes First Flight

First production model of Aermacchi-Lockheed's Santa Maria light aircraft made its first flight recently at the company's airport in Venegono, Italy. Plane, designed by Lockheed's Georgia Division and manufactured by Aermacchi in Italy, is being marketed as a bush transport. The first Italian production model is undergoing certification tests by the Registro Aeronautico Italiano. U. S.-built prototypes already have been certificated by the Federal Aviation Agency. Plane is similar to the Lockheed-Azcarate LASA 60 being manufactured under similar arrangements in Mexico (AW Apr. 17 p. 131).

Near-Miss Reporting Program Established

Washington—Federal Aviation Agency has awarded Flight Safety Foundation a contract to develop a near-miss reporting program intended to encourage pilots and controllers to inform the agency of barely avoided midair collisions.

Developed jointly by Civil Aeronautics Board and FAA, the program is designed to establish a uniform national system for near-miss reporting by civil and military air crews. Flight Safety Foundation has been asked to decide how such data is to be analyzed.

The filing of near-miss or incident reports almost ceased during 1960 after pilots began accusing former FAA Administrator E. R. Quesada of using the information to launch disciplinary action. "We pledge that these reports will not be used as a basis for punishing the reporter," FAA Administrator N. E. Halaby said last week. All reports are to be considered confidential.

The program's six-month cost will be $80,000. It will cost a total of $140,000 if FAA decides to continue it for another six months.

PRIVATE LINES

Garrett Corp.'s AiResearch Aviation Service Division is converting two Grumman Gulfstreams to aerial laboratories for Grumman Engineering Co. which will contract the aircraft to the FAA Research and Development Center, NAFEC, Atlantic City, N. J. Federal Aviation Agency will conduct performance tests on various airways navigational systems and airborne equipment with the Gulfstreams.

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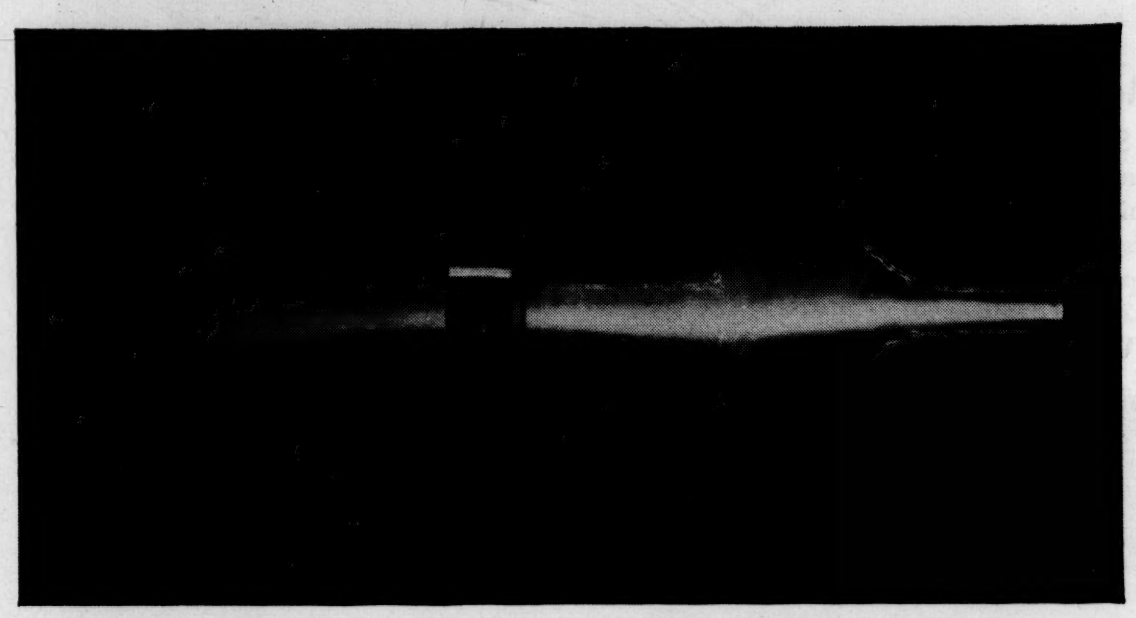

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You are invited to contact Mr. W. D. Walsh, Personnel Department

RESEARCH LABORATORIES
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All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

WHO'S WHERE

(*Continued from page 23*)

Changes

R. W. Tharrington, assistant general manager, The Boeing Co.'s Aero-Space Division, Seattle, Wash. Also: **Dr. R. A. Montgomery,** staff engineer for review, appraisal and guidance of technical aspects of the Minuteman intercontinental ballistic missile program; **Dr. Yusuf Yoler,** staff engineer for review, appraisal and guidance of technical aspects of the Dyna-Soar manned space glider program.

Charles H. Crosby, head of Minuteman field operations at Cape Canaveral, Fla., for Aerojet-General Corp., replacing **Alfred J. Koorey,** reassigned to Aerojet's Solid Rocket Plant, Sacramento, Calif.

Dr. Robert E. Payne, director, Atlantic Missile Range Office of Aerospace Corp. at Cape Canaveral, Fla.

Herbert J. Weston, technical service engineer, Kaylock Division, Kaynar Mfg. Co., Inc., Los Angeles, Calif.

Lionel Rogers, director of traffic administration, American Airlines, Inc.

Hugh E. Webber, director, Technical and Research Staff, The Martin Co.'s Orlando (Fla.) Division, succeeding **James G. Houser,** now program manager, Missile Master and BIRDiE air defense coordination systems manufactured by Martin for the Army.

Robert F. Garbarini, chief engineer, Sperry Gyroscope Co.'s Air Armament Division, Great Neck, N. Y.

Donald L. Johnson, manager, Manufacturing Section, General Electric Co.'s Defense Systems Department, Syracuse, N. Y.

Dynamic Science Corp., a subsidiary of Marshall Industries, South Pasadena, Calif., has announced the following appointments: **Dr. Robert D. Allen,** member, technical staff; **Harold G. Weiss,** senior chemist.

Victor V. Myers, Jr., assistant director of engineering, Systems Division, Consolidated Systems Corp., Monrovia, Calif.

William S. Blakeslee, group executive-defense, Chrysler Corp., Detroit, Mich.

Dale V. Ness, director of the Washington (D.C.) office of The Mitre Corp., succeeding **Bryan F. LaPlante,** now special assistant to the president.

Ernest M. Whitley, chief mechanical engineer, Shockley Transistor Section of Clevite Transistor, Palo Alto, Calif.

Arthur S. Lochner, manager, Curtis Optical Department of Fairchild Camera and Instrument Corp.'s Defense Products Division, Los Angeles, Calif.

Vernon P. Grove, head of Lockheed Aircraft Corp.'s Colorado Springs (Colo.) office.

Frank P. Wilton, director of corporate development, The Firewel Company, Inc., Buffalo, N. Y., a subsidiary of Aro Equipment Corp.

James J. Kilroy, engineering section manager-communications, U. S. Science Corp., Los Angeles, Calif.

Louis Kraff, Jr., manager, Space Instrumentation Division, Technology Instrument Corp. of Acton, Mass.

Thomas A. Holdiman, chief of systems controls, Military Products Division, General Dynamics/Electronics, Rochester, N. Y.

Al Zirkes, staff engineer for safety, Wyle Laboratories, El Segundo, Calif.

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Space Scientists — BS or MS in EE, or Physics with 5-7 years experience in instrumentation, to work in development of measurement devices and measurement systems with emphasis on space sciences and aircraft. Should have knowledge of geophysical and celestial measurement techniques, inertial components and data acquisition systems.

Digital Computer Systems Engineer — BSEE with a minimum of 4 years experience in the analysis design and development of digital computers. Will participate in the integration of digital computer into a complex weapons system. A significant part of the effort will be devoted to extensive laboratory and flight development programs.

Communications Systems Engineer — Electronic Engineers with thorough knowledge of communications techniques who wish to extend their technical background to new challenging areas. An important phase of this effort will be extensive laboratory development programs in our new Electronics Systems Center using the finest of equipment and facilities. BSEE with a minimum of 3 years experience.

ASW Systems Analyst (Underwater Acoustics) — BSEE or BS in Physics with a minimum of 3 years experience in sonar or acoustics. To conceive and work on new detection & classification techniques and advanced airborne, surface & submerged ASW Systems. Work will involve the application of ASW techniques to airborne, hydrofoil, surface ship and submarine phases of the problem.

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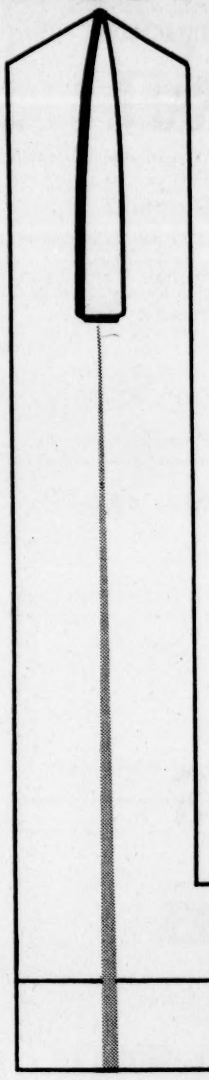

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Note to Structural Engineers:

If you feel your career requirement at this time is a more challenging assignment, Boeing's Transport Division can offer you opportunities to advance with such programs as the newly-announced short-range 727 jetliner, supersonic flight projects and other advanced commercial programs.

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LETTERS

Gilding the Guilder

The article "Devaluation Spurs KLM Modernization" on p. 42 of your May 29 issue, while correct in its interpretation of the economic effects of the change in the guilder's value, does misuse the word "devalue." In fact, the guilder has been revalued upward, not devaluated. Since a dollar is now worth fewer guilders, a guilder is now worth more dollars. It is the dollar that has been devaluated in terms of the guilder.

FRANKLYN J. DAVENPORT
Seattle, Wash.

B-58 Training

In your June 5 issue, Production Briefing, p. 78, you make note that personnel of the 305th Bomb Wing were trained by the 43rd Bomber Wing at Carswell AFB, Tex.

While this is significant, I would like to point out that these personnel are being given B-58 Lead-In training in the F/TF-102 by the 3555 Flying Training Wing (Advanced Interceptor), Perrin AFB, Tex.

I wish to compliment AVIATION WEEK for its excellent editorials and coverage of both military and civil aviation. Your magazine is enjoyed by many of us.

MURRAY J. HANCOCK, JR.
1st Lt., USAF
Perrin AFB, Tex.

Patriotic Fervor

Since when have Americans been afraid of war? The AVIATION WEEK (June 5, p. 25) report in Washington Roundup that American Generals are not permitted to use the word war, together with the report in the Saturday Evening Post (June 10) that Kennedy's chief science advisor, Jerome Wiesner, favors disarmament is disgusting and nauseating to freedom-loving Americans. Our love for freedom and liberty, which Communist Russia threatens to end, transcends any fear of war and destruction, reviving in our hearts and minds those words of patriot Patrick Henry, "Give me liberty or give me death."

WILLIAM A. TRACY
Burbank, Calif.

No-Show Rights

Has Mr. Grant flipped his wig (AW May 29, p. 112)? I'm surprised he doesn't ask for the death penalty for "no shows." The right to "no show" is akin to my wife's right to return the things she buys in the local department store. Oh, yes, it gives the management ulcers, but that's America and that's business—profitable business. Take the privilege away and business is worse, not better. Why should the federal government be called upon to collect from a "no show"? We pay our taxes to maintain a safe highway and airway system, that is available to all to use when they please. The 10% transportation tax is a nuisance tax imposed to discourage travel during the war. It does not pay for the airways specifically; it is simply dumped into the general treasury. Whether Mr. "No Show" travels or not may cost the airline the profit on a seat, but the effect on the airways system isn't measurable. The flight will go just as if the seat hadn't been sold in the first place. In fact, the no show problem is for the most part no problem at all, since the average flight in this country is far from a complete sell-out—just look at the load factor figures in AVIATION WEEK.

On June 1 a friend visited me here in Washington while here on a business trip. He had a reservation on an Eastern flight to Newark at 9:00 p.m.; at 8:30 we were just starting dessert after a pleasant dinner, so I called Eastern, canceled the reservation and asked if they could suggest a later flight. The agent courteously listed several, including those of other airlines. I called United to make a reservation on their 10:10 flight, and the agent said to be at the airport one hour before flight time to hold the reservation. I suggested that since the flight time to Newark is one hour it was absurd to be at the airport one hour before flight time. She negotiated down to 45 minutes, but refused to commit United any further. We arrived at the airport fifteen minutes before flight time and my friend boarded the flight with no problem at all. There were three flights leaving for Newark, plus one for La Guardia and one for Idlewild in those fifteen minutes, so if United dared to cancel the reservation there was ample opportunity to castigate them and find alternate accommodations.

Is it moral to cancel on a whim? You bet your life it is. You pay for this privilege, and you are cheating yourself if you don't exercise it now and then. When my friend "jumped" airlines and couldn't get United to commit themselves on a firm reservation unless he would come where he could be watched in a United passenger pen for one hour, he was paying $17.40 plus $1.74 tax. He could have strode into the airport a few minutes earlier, pulled a numbered tag out of a machine, walked on an Eastern Constellation, sat down, and bought his ticket on his way to New York (yes, on the plane). What if the plane was full? Why Eastern simply pulls up another. The fare is $12.73 plus $1.27 tax. The difference of $5 is due largely to the elimination of the reservation run-around. This is an intelligent solution to the reservation problem: eliminate the need for reservations. Another solution where traffic does not support a guaranteed seat operation on a no reservation basis is to charge a higher fare for the reservation, if desired, as is done on the Pittsburgh, Philadelphia, and Boston routes of Allegheny.

The office I work in (20 people) spends over $15,000 a year on air travel, $5,000 of which goes to Eastern, and my monthly bill to the local department store is fairly sizable, so I don't feel a bit guilty if I give them a hard time now and then.

DICK D'ANTONIO
Arlington, Va.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

ICBM Workability

The article on national defense on p. 22 of your May 22 issue quotes a House Armed Services Committee report to the effect that the committee is continuing strategic bomber production since "The committee is unwilling to place the safety of this country in a purely academic attitude . . ." because ". . . our only knowledge of the actual workability of an ICBM fired in anger is in textbooks and in laboratories."

Granting that the committee is correct in their actions, does anyone believe that our country's ability to defend itself is increased because a complete ICBM with nuclear warhead has never been test fired by the USA?

PETER A. HUSSEY
San Mateo, Calif.

Pilot Retirement

I thought I was going to have a quiet holiday, but I just noticed in your Airline Observer column (AW May 29, p. 46) that "International Civil Aviation Organization has recommended to 34 nations that airline transport pilots . . . retire at age 60, 'because of the increasing possibility of sudden incapacity in a pilot with advancing age'."

Possibly ICAO may have better insight to the proper application of pertinent statistical data at the international level than I feel our own FAA and courts have had at the domestic level.

First, I must say I haven't run a check on such matters as how long the span of an Egyptian, or how come the rate of the rain that falls on the plain in Spain, and how such factors might affect the mandatory retirement of, for example, an Israeli pilot.

Nevertheless, the fleeting thought crosses my mind that ICAO may be making one of those prestige recommendations that can result in injustice to innocent groups without reason. This sometimes happens at the level of clothesline gossip, too.

However, I hope you will permit me to congratulate ICAO on one very important point. I gather it does not also intend to make the laws, too, for the 34 nations that it proposes to tell how to run their business.

Tell me, how does one go about joining ICAO. Does one have to own an airline or two—or would two shares of airline stock, at present market value, do?

ROBERT E. TRIMBLE
Washington, D. C.

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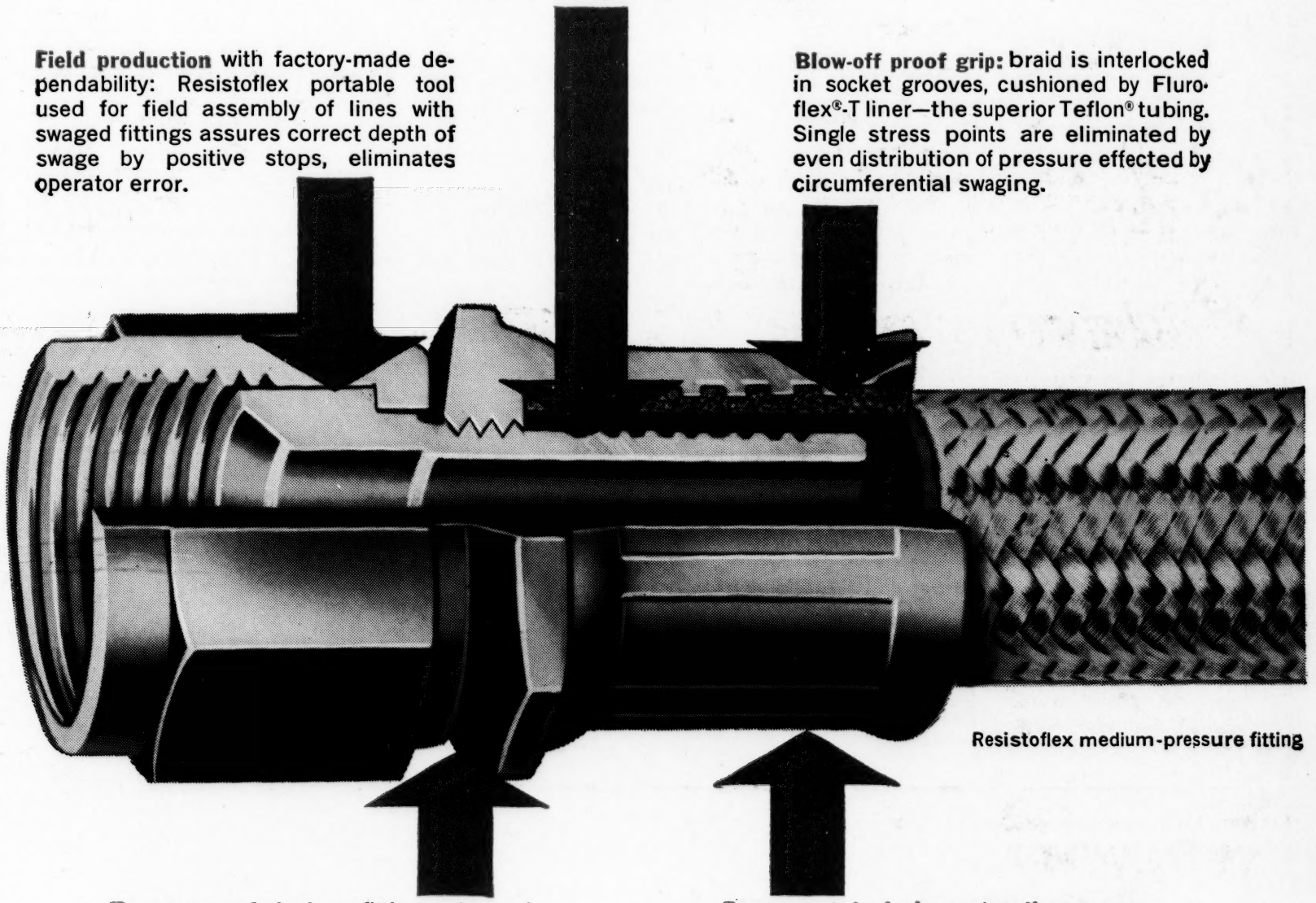

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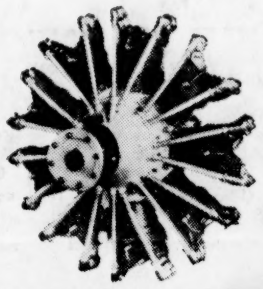

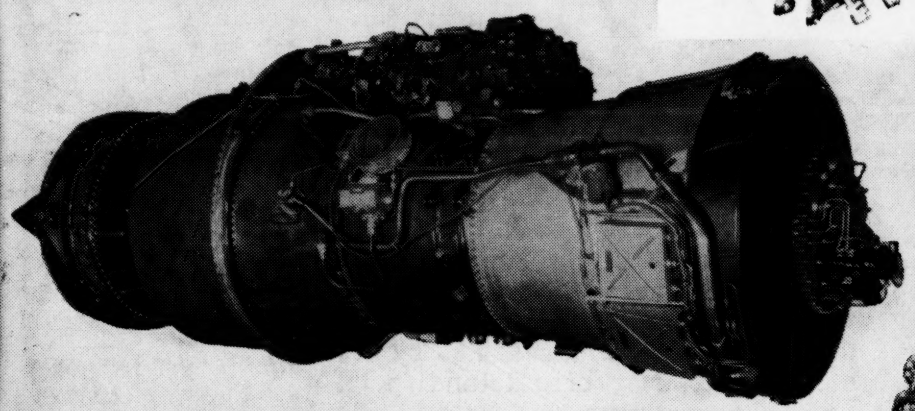

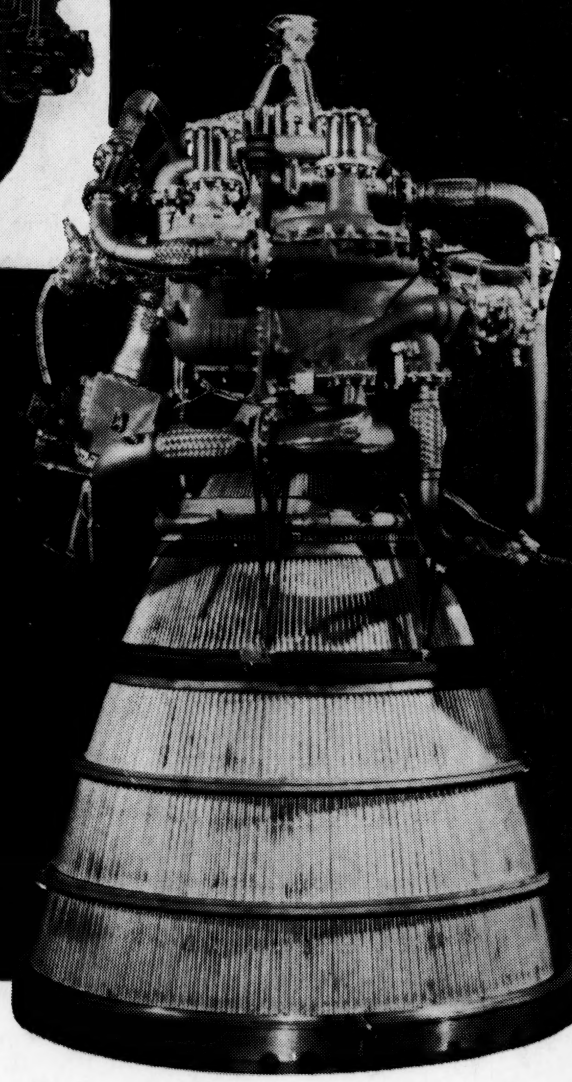

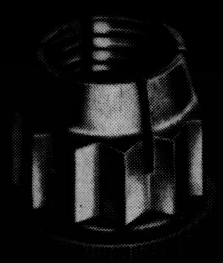

Type Z1855

Type LH3417

Thirty-five years ago the original Wasp engine, developed in 1925 by Pratt & Whitney Aircraft, helped to catapult America from third rank to world leadership in aviation. Today its J-57 and J-75 jet engines power many of this nation's highest flying and fastest bombers, fighters, and commercial jetliners. Meanwhile, still newer powerplants, like the LR-115 rocket engine, are under development at Pratt & Whitney Aircraft's Florida Research and Development Center. The LR-115, the nation's first liquid hydrogen rocket engine, will power the Centaur space vehicle scheduled for flight in 1961 and will boost multi-ton payloads into high orbits or power deep space probes.

Progress in engine design and performance represented by these three engines obviously required matching improvements in all component categories as well. The Elastic Stop® nuts that were standard parts for the early Wasps were constantly supplemented by new designs equal to the special temperature, load and environmental conditions demanded by this power-plant evolution.

The Elastic Stop nuts illustrated here are specified in several sizes for the assembly of pipe flanges, brackets, engine mounts and pump flanges of the LR-115. They are typical of the fasteners designed for compatibility with the liquid hydrogen environment and unusual very high–very low temperature demands of this rocket engine.

ESNA has consistently accepted a full share of the responsibility to investigate and propose solutions for fastening problems created by the changing technology of the engine industry. These efforts have helped to establish and maintain ESNA's position as the foremost supplier of self-locking nuts specifically designed and produced to the unique reliability requirements of the aircraft engine industry. Write ESNA for a copy of High Temperature Design Catalog No. 5918.

#583

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